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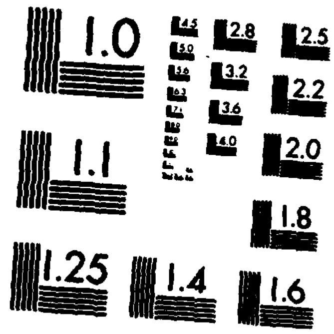

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Report No. DOT/FAA/RD-81/18
DOT/FAA/CT-81/27

AD-A138 414

DISCRETE ADDRESS BEACON SYSTEM (DABS)/ AIR TRAFFIC CONTROL RADAR BEACON SYSTEM (ATCRBS) ELECTROMAGNETIC COMPATIBILITY STUDIES

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DEPARTMENT OF TRANSPORTATION • UNITED STATES OF AMERICA

FINAL REPORT

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16. Abstract

This report describes the test procedures and results of the Discrete Address Beacon System (DABS) and Air Traffic Control Radar Beacon System (ATCRBS) compatibility studies performed at the Federal Aviation Administration (FAA) Technical Center. Four terminal ATCRBS processors: Automated Radar Terminal System (ARTS III), ARTS IIIA Sensor Receiver and Processor (SRAP), ARTS II, an AN/TPX-42, and the en route common digitizer were subjected to various anticipated DABS/ATCRBS asynchronous reply (fruit) environments.

Maximum expected DABS fruit rates will not degrade performance of facilities using defruited video. The common digitizer, which does not employ a defruiter, performed with no significant degradation in the various DABS fruit environments. The SRAP, which is planned to be implemented in terminal facilities to replace the existing ARTS III Beacon Data Acquisition Subsystem (BDAS), will experience overloading of reply and report buffers by the addition of DABS fruit if a defruiter is not used. A defruiter eliminates the overload conditions to the expected maximum DABS fruit rate but adversely affects the SRAP performance. The implementation of a DABS preamble detector, which eliminates the DABS fruit from the beacon video input to the SRAP, will allow the use of undefruited video at those facilities currently using undefruited video without overloading the processor in a DABS fruit environment. Combined uplink/downlink tests with a DABS sensor spotlighting an ATCRBS transponder resulted in no degradation of ARTS III target reports or track reliability.

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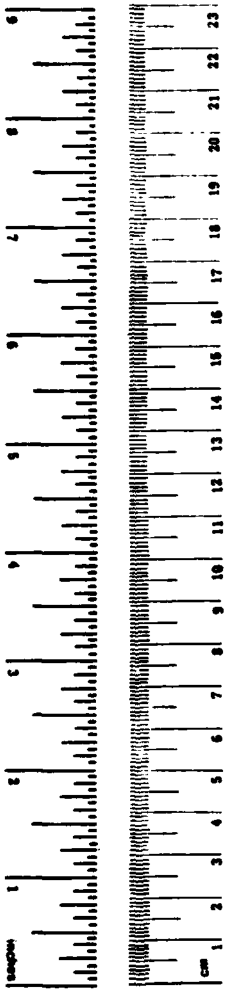
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

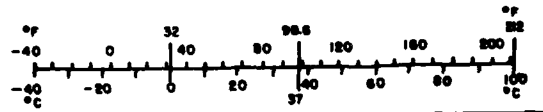
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in ≡ 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



PREFACE

Acknowledgment is made to the following personnel for their assistance in this effort:

Michael McNamee, Frank Rosati, and Adam Magoss for conducting the reply processor tests and reducing the resultant data.

Mark Schoenthal and Linda Miller for the design of data reduction and analysis software.

Edward Mancus for the design of specialized test equipment.

Donald Rogers, Roy Gilmartin, and John Stanks for the fabrication of all test hardware.

John Zvanya for preparation of charts and graphs.

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INTRODUCTION

PURPOSE.

The purpose of this report is to present additional data collected and the final analysis from the Discrete Address Beacon System (DABS)/Air Traffic Control Radar Beacon System (ATCRBS) compatibility tests conducted at the Federal Aviation Administration (FAA) Technical Center. Preliminary test results were previously published in report No. FAA-RD-79-71, "Interim Results of DABS/ATCRBS Electromagnetic Compatibility Testing," dated June 1979.

BACKGROUND.

The DABS is being developed by the FAA as an evolutionary upgrading of the existing ATCRBS. DABS provides improved surveillance data and an integral ground-air-ground digital communications data link to support advanced air traffic control automation. DABS has been designed to be compatible with ATCRBS to permit an orderly and economical transition from an all-ATCRBS environment to an all-DABS environment. The DABS design achieves this compatibility by using signal waveforms that operate on the same frequency channels as ATCRBS and supports ATCRBS functions as well as DABS functions.

PURPOSE OF TEST ACTIVITY.

The common channel usage by DABS and ATCRBS raises the issue of mutual interference. The question to be answered is, would the implementation of DABS degrade the performance of neighboring unmodified (non-DABS) ATCRBS installations during the ATCRBS-to-DABS transition period? A theoretical DABS/ATCRBS interference analysis ("Discrete Address Beacon System (DABS) Air Traffic Control Radar Beacon System (ATCRBS) Interference Analysis," report No. FAA-RD-78-147), hereafter referred to as the theoretical analysis, was performed and concludes that DABS can coexist with ATCRBS on the same frequency channels on a noninterfering basis. The purpose of this test effort was to verify the predictions and conclusions resulting from the theoretical analysis.

TEST OBJECTIVE.

The objective of the DABS/ATCRBS electromagnetic compatibility test activity was to quantitatively determine the effect of DABS transmissions on ATCRBS performance on the interrogation (uplink) and reply (downlink) channels, and to determine corrective action if a compatibility problem exists.

TECHNICAL APPROACH.

Test configurations were established to examine in detail the potential interference mechanisms identified in the theoretical analysis. The test configurations included flight tests for verification of the uplink channel predictions and the use of appropriate environment drivers which provided realistic representations of the operating environment at the input port of operational ATCRBS processors.

RELATED ACTIVITIES.

DABS/ATCRBS electromagnetic compatibility computer simulations were conducted by the Electromagnetic Compatibility Analysis Center (ECAC) for the FAA. The FAA Technical Center test data resulting from flight tests and tests conducted with the actual operational reply processors were used to crosscheck ECAC computer simulation results.

A joint FAA/Department of Defense (DOD) program investigated the compatibility of DABS with the military Mode 4 operation (see classified report FAA-RD-81-19, "Discrete Address Beacon System (DABS) to an AN/GPA-124 Coder-Decoder (Mode 4) Electromagnetic

Compatibility Test Results," to be published approximately September 1981). Further, the compatibility of DABS with operational Tactical Air Navigational Aid (TACAN) Systems is being investigated and will be reported separately.

SCOPE OF EFFORT.

The equipments tested were current ATCRBS operational equipments in the FAA inventory and equipments used jointly by the FAA/DOD operating on 1030 and 1090 megahertz (MHz) frequencies for air traffic control. The ATCRBS processors tested were the Automated Radar Terminal Systems (ARTS) III Beacon Data Acquisition Subsystem (BDAS), ARTS IIIA sensor receiver and processor (SRAP), ARTS II, AN/TPX-42, and the en route common digitizer (CD). The ARTS IIIA SRAP systems are presently being commissioned in terminal facilities. The ARTS III, ARTS II, and AN/TPX-42 are currently operational equipments at terminal facilities and the CD at en route facilities.

DISCUSSION

DESCRIPTION OF DABS OPERATION.

DABS is a cooperative surveillance and communication system for air traffic control. Each aircraft is assigned a discrete address or unique code which permits data link communications to or from a particular aircraft. The data link operates integrally with DABS surveillance interrogations and replies. DABS has two modes of operation: ATCRBS and DABS. DABS uses the channel first for ATCRBS functions, and then for DABS functions. This is possible because DABS employs monopulse direction finding which permits reliable and improved ATCRBS surveillance data to be obtained with a nominal 4 "hits" per target, contrasted to today's ATCRBS which nominally obtains 16 to 30 hits per target. The time between ATCRBS interrogations is used to perform DABS surveillance and data link communications. In the DABS mode, surveillance data on a DABS-equipped aircraft can be obtained normally with a single interrogation (the reinterrogation factor is about 10 percent). Because of discrete addressing, DABS can schedule interrogations such that responses are never received simultaneously. Only aircraft on the sensor's "roll-call" list can be discretely interrogated. To acquire targets not yet on roll-call, DABS periodically transmits an ATCRBS/DABS all-call interrogation, which is similar to the present ATCRBS interrogation with an additional pulse, P4. An ATCRBS transponder is unaffected by the presence of the P4 pulse and responds with a normal ATCRBS reply. DABS transponders recognize the interrogation as a DABS all-call interrogation and respond with a DABS all-call reply which contains its discrete address.

After determining its position, the sensor places the target on its roll-call list. On a subsequent discrete interrogation the DABS transponder can be locked-out from replying to all-call interrogations, thereby, eliminating unwanted replies. In the ATCRBS mode, DABS transmits a P2 suppression pulse on the omnidirectional antenna each time there is an ATCRBS/all-call interrogation, just as is presently done in the current ATCRBS to suppress ATCRBS transponders outside of the antenna's main beam. In the DABS mode, each discrete interrogation consists of a preamble containing P1-P2 suppression pulse pairs to suppress ATCRBS transponders that are in the antenna main beam with the DABS target being interrogated. This intentional suppression (nominally 35 microseconds (μs)) prevents unwanted ATCRBS replies from being triggered by a discrete interrogation.

Each DABS reply consists of a 4-pulse preamble designed to make the DABS reply easily distinguishable from an ATCRBS

reply. DABS replies can be 64 or 120 μs long as compared with an ATCRBS reply which is nominally 20.3 μs.

POTENTIAL INTERFERENCE MECHANISMS.

It was found in early DABS studies that any form of data modulation could trigger many ATCRBS transponders to respond with unwanted replies. DABS prevents this by using an interrogation waveform that will intentionally suppress any ATCRBS transponder which detects the interrogation. The remainder of the DABS transmission is then completed during the nominal 35 μs ATCRBS suppression interval. Therefore, the potential uplink interference mechanism is the intentional suppression of ATCRBS transponders. DABS has the capability of transmitting extended length messages (ELM) which may contain up to 16 segments. The ELM segments or COMM-C interrogations can be transmitted in a burst with a minimum spacing of 50 μs. The transmission of multiple segment ELM's raises questions regarding the effect that these interrogations have on the ATCRBS transponders' round reliability, especially when the ATCRBS is in the main beam with more than one DABS target receiving multisegment ELM's. The peak interrogation rate of DABS is 96 interrogations in 40 milliseconds (ms).

DABS asynchronous replies (fruit) is the principal interference mechanism on the downlink channel. A DABS reply is either 64 or 120 μs long and is transmitted using pulse position modulation. The DABS reply has pulse widths and spacings which are close to those used in ATCRBS replies. Thus, a DABS reply may be falsely decoded as a string of overlapping ATCRBS reply brackets.

ATCRBS reply processor performance may be degraded due to the false bracket decodes. Additionally, ATCRBS replies that are garbled by DABS fruit may go undetected or be erroneously decoded. This may also degrade reply processor performance.

DESCRIPTION OF EQUIPMENT.

ARTS III. The ARTS III converts beacon video into digital target reports. It is a modular design incorporating a hardware BDAS, an input/output processor (IOP), a digital tape drive, a teletype, a common equipment cabinet, and a display.

The BDAS is a hard-wired beacon processor that performs (on a sweep basis) azimuth decoding, mode trigger recognition, garble sensing, and transfer of this data to the IOP for subsequent processing.

The IOP is a general type computer that provides for the expansion of the computer memory core in 8,000-word modules. The system at the FAA Technical Center Terminal Facility for Automation and Surveillance Testing (TFAST) presently employs a memory size of 40,000 words. The IOP accepts azimuth, replies, and status information words from the BDAS. It performs target detection, target tracking, display functions, and keyboard input functions from the controller, and outputs data functions to the ARTS III display and the on-line teletypewriter.

The display provides the capability of presenting: (1) raw beacon, (2) raw radar normal and moving target indicator (MTI) videos, (3) BDAS bracket decodes, (4) digital targets as detected by the IOP program, (5) target tracks, (6) system data, and (7) alphanumeric information for targets and target tracks. The keyboard associated with the display permits direct communication by an operator with the IOP program.

The common equipment inputs radar trigger, azimuth change pulses (ACP's), and the azimuth reference pulses (ARP's). These signals are used to derive the

range marks and sweep for the ARTS III display.

The tape drive is required to load: (1) the operational program, (2) diagnostics for the IOP and peripheral equipments, and (3) special utility programs into the IOP. It is also used to extract various types of data from the IOP such as beacon replies, target reports, track data, and keyboard entries. It also provides the capability of dumping the contents of the IOP memory onto magnetic tape.

ARTS II. The ARTS II system is an ATCRBS processor consisting of a hardware unit and a 16-bit minicomputer. The hardware unit detects ATCRBS replies from the beacon video and transfers position, mode, and detected identity and altitude code information to the minicomputer. The minicomputer performs beacon input processing, display functions, system monitoring, tracking, and keyboard input processing. It is capable of driving up to 11 displays and processing input from up to 22 keyboards. The minicomputer is also capable of recording target and reply data onto digital magnetic tape. The memory is expandable in 32,000 segments up to 256,000.

AN/TPX-42. The AN/TPX-42A (V4) is a hardware beacon video processor used by the FAA. The AN/TPX-42A receives beacon video, mode triggers, and beacon synchronization from air traffic control radar beacon interrogator (ATCBI) equipment. Radar pretrigger and synchronization data are received from primary radar. These input signals are processed by the AN/TPX-42A to provide bracket video and synthetic target data. The synthetic target data are transferred as output messages to display equipment to display position, code, and altitude of transponder-equipped aircraft.

SRAP. The SRAP BDAS consists of a hardware beacon extractor (BEX) and a beacon microcomputer. The SRAP receives beacon video from the secondary radar to detect target replies. The ACP's and ARP's are input to define antenna position; mode triggers are input to define mode interlace. The BEX sends azimuth words to the beacon microcontroller (BMC) to define azimuth and mode and sends range and code words for received replies. The BMC performs azimuth correlation of the received replies and outputs target reports. It also performs correlation with radar reports and outputs all data to the ARTS III computer.

AN/FYQ-47, AN/FYQ-49. The AN/FYQ-47 or AN/FYQ-49 common digitizer is a radar/beacon processor for en route radar. The equipment accepts raw video from a common use set of Air Force or FAA radars and beacon equipments to perform target detection. The digital data derived from the processing of the raw video are formatted and transmitted over telephone lines to an Air Force Direction Center and/or an FAA air route traffic control center (ARTCC).

MX-8757/UPX INTERFERENCE BLANKER. This is a digital defruiter which is designed to eliminate asychronous replies by delaying all of the pulses in one PRF, and then comparing them with those in the next PRF. The pulses that are not coincident in each period are eliminated. Defruiters are normally used at all terminal facilities to eliminate fruit prior to processing.

DABS FRUIT GENERATOR. The DABS fruit generator is a hardware unit fabricated at the Technical Center (in-house) to simulate DABS fruit replies. It is capable of generating DABS fruit rates from 0 to 2,000 replies per second in 4 replies per second increments. Selection of the percentage of extended length message DABS replies (112 μs), short DABS message replies (56 μs), and selection of desired reply codes and percentage mixture of the selected codes are programmable features. The unit also accepts input ATCRBS video and

mixes and outputs combined DABS fruit and ATCRBS video.

ATCRBS TARGET/FRUIT GENERATOR. The ATCRBS target/fruit generator is a hardware unit fabricated at the FAA Technical Center (in-house) which is capable of generating simulated ATCRBS targets, nonsynchronous ATCRBS fruit, and internally generated ACP's and ARP's. The ATCRBS targets can be varied in range, azimuth, identity and altitude codes, run length, and reply probability.

The number of targets per scan, the ATCRBS fruit rates, the run length distribution, and the overall reply probability of the targets are all programmable features built into the unit. The azimuth generator is capable of simulating various antenna speeds.

DABS PREAMBLE DETECTOR. The DABS preamble detector, designed and built at the Technical Center, is capable of detecting and eliminating DABS replies. The unit accepts mixed ATCRBS and DABS video and deletes DABS replies upon detection of the 4-pulse DABS preamble. The unit was designed with flexibility in the preamble detection criteria.

METHOD OF APPROACH.

To accurately measure and predict the effect on system performance to the various ATCRBS processors due to the injection of DABS fruit, a simulation of the live environment was deemed the proper data base input. Therefore, the live environment at the TFAST facility was measured in terms of target run length distribution and reply probability to characterize the terminal environment. A detailed discussion of the data derived from the statistical samples from the TFAST facility and the implementation of the ATCRBS target/fruit generator to simulate the distributions is given in appendix C of report No. FAA-RD-79-71, "Interim Results of DABS/ATCRBS Electromagnetic Compatability Testing," dated June 1979. The en route run length distribution was derived from statistical samples from en route sites with an NADIF antenna and ARSR-1, 1E, or ARSR-2 sails. The ATCRBS target/fruit generator was configured to output two rings of 32 test targets each for a total of 64 targets per scan. The target run length distribution and overall reply probability were programmed into the ATCRBS target/fruit generator. The average reply probability values derived from the live samples at the TFAST facility was approximately 0.90. Tests were also performed on the ATCRBS processors at lower reply probabilities to encompass terminal facilities which experience or may experience reduced reply probabilities. The test targets were mixed with six values of ATCRBS fruit rates from 0 to 10,000 fruit per second, which encompasses the full range of ATCRBS fruit rates experienced at terminal facilities. The ATCRBS target/fruit generator also provided all the trigger and azimuth information to the processor normally provided by the ATCRBS interrogator and antenna system at the terminal facilities.

The various ATCRBS environments simulated were injected into the beacon video input of each processor, the same as they would have been received from the receiver quantizers of either an Air Traffic Control Beacon Interrogator (ATCBI)-4 or ATCBI-5/receiver unit. Some of the processor test setups required defruited video. The MX-8757/UPX interference blanker was implemented and inserted between the processor beacon video input and the generated beacon test video output, the standard defruiter installation in operating facilities. DABS fruit generated by the in-house unit was mixed with the ATCRBS test video, then input to the beacon video input of the processor or to the defruiter when used. The DABS fruit rates ranged from 0 to 200 fruit

per second. Specific values selected were 0, 10, 20, 40, 75, 100, 200, and 400 DABS fruit per second. Based upon the 1982 and 1995 traffic models, it is not expected that DABS fruit rates in excess of 100 replies per second will be experienced when DABS is implemented. Nonetheless, tests at higher DABS fruit rates were conducted to provide continuity of data and to assure consistent operation of each reply processor.

Each of the processors were commonly tested in terms of percent detection, splits, false alarms, and code validation. Percent detection was determined by searching for targets at the precise locations in range and azimuth where they were generated by the ATCRBS target/fruit generator. Target splits were declared when more than one target appeared at the same location where only one was generated. False alarms were determined by detecting any target that did not occur within the allowed range and azimuth locations where targets were generated. Code validation data were determined by counting the number of targets processed with correct codes, and classifying these according to the validity assigned them by the processor under test. The same was done for the number of targets received with incorrect codes.

The ARTS III, SRAP, and ARTS II systems have common algorithms to assign mode 3/A code validity. The code validity is a 2-bit field and the algorithm is as follows:

0 = All replies are garbled

1 = One reply is not garbled

2 = One garbled reply and one ungarbled reply have identical codes

3 = Two ungarbled replies have identical codes

Code validation for the AN/TPX-42 and the common digitizer is a 1-bit field indicating that the code was either validated or not validated.

All processor F1-F2 bracket tolerances were set to the accepted standard which is 20.3 ±200 nanoseconds.

DATA SET — ATCRBS.

The following data set was used for the testing of all reply processors (both en route and terminal).

1. Two rings of 32 targets each.

2. Azimuth offset of two ACP's between targets in adjacent rings.

3. Code generators 0 and 1 were used for fruit with the following codes: 0737, 7024, 1231, 0541, 0647, 0567, 3022, and 7030.

4. Code generator 2 was used for targets with the following codes:

a. 3/A codes 7056 and 6761.

b. C codes 6630 (8,100 ft) and 5724 (36,000 ft).

5. All runs were made in the auto update mode:

a. 150 scans at 0 fruit rate.

b. 7 scans off.

c. 150 scans at 500 fruit per second.

d. 7 scans off.

e. 150 scans at 1,000 fruit per second.

f. 7 scans off.

g. 150 scans at 2,500 fruit per second.

h. 7 scans off.

i. 150 scans at 5,000 fruit per second.

j. 7 scans off.

k. 150 scans at 10,000 fruit per second.

l. End of test.

6. Reply probability was 90 percent unless otherwise specified. The percentage distribution of the simulated reply probabilities implemented for the compatibility tests are shown in figures 1 and 2 for terminal, and en route simulations of 0.90, 0.80, and 0.70. The en route distribution appears smoother due to the longer target run lengths, which allows more discrete values to be obtained.

The following azimuth rate, PRF, and interlace ratios were used in the respective en route and terminal systems testing.

	En Route	Terminal
Azimuth Rate (sec/scan)	10.0	4.72
PRF	360	343
Interlace Ratio	3,3,C,3,3,C	3,C,3,C

DATA SET — DABS.

The DABS data set consisted of 20 different messages with random generated message content. The messages, along with the measured percentage contribution of each, are listed in table 1. As indicated, approximately 25 percent of the messages were 112 bits. Both fruit generators contained the same message set. The output of the two DABS fruit generators implemented to obtain the desired DABS fruit rate was analyzed to determine the time distribution of the replies. The data are shown in figures 3, 4, and 5 for 10, 20, 40, 75, 100, 200, and 400 DABS fruit per second, the fruit rates required for the compatibility tests. The data are plotted in percentage as a function of reply-to-reply spacing, and also plotted in percentage number of replies in a given time sample. For example, the 10 DABS fruit per second time distribution are plotted in figure 3. The sample interval to determine the percentage occurrences was 400 milliseconds. Ten DABS fruit per second should average one DABS reply every 100 milliseconds or four DABS replies every 400 milliseconds. The average number of occurrences shown by figure 3 is four, and the average reply-to-reply spacing is approximately 100 milliseconds. The DABS fruit distributions indicate that the time distributions are fairly flat or evenly distributed. ATCRBS fruit time distributions are presented in figures 6, 7, and 8 for rates of 500, 1,000, 2,500, 5,000, and 10,000 fruit per second.

One of the purposes of the test activity was to determine corrective action, if necessary, to permit ATCRBS reply processors to operate in a DABS fruit environment. It was determined that a unit which could detect and blank a DABS reply, thereby, not allowing the DABS data message to pass to the ATCRBS processor, would effectively eliminate any degradation that DABS fruit might cause. The DABS preamble detector was built to perform the above function.

Data were collected to optimize the preamble detector performance. A presentation of the results is included in this report. Several of the processors were tested with the preamble detector to compare their performance to the standard configurations.

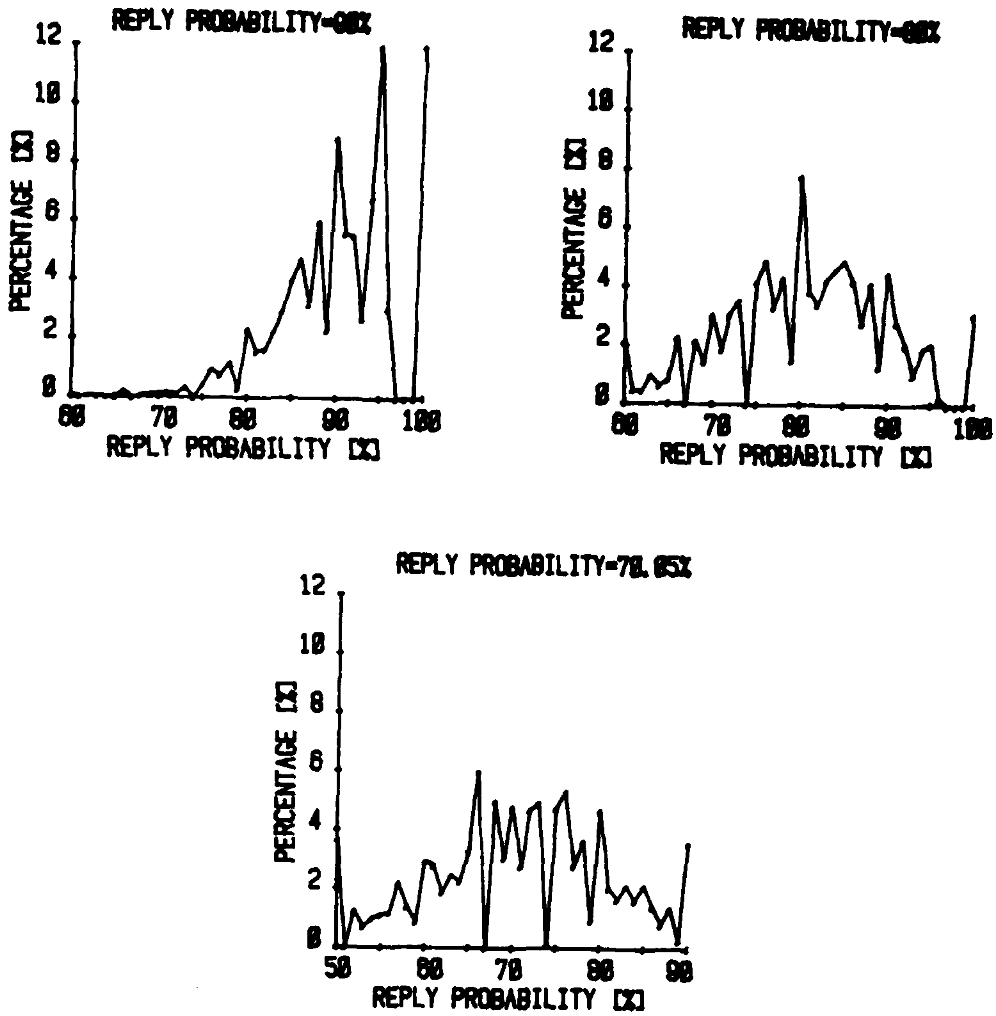

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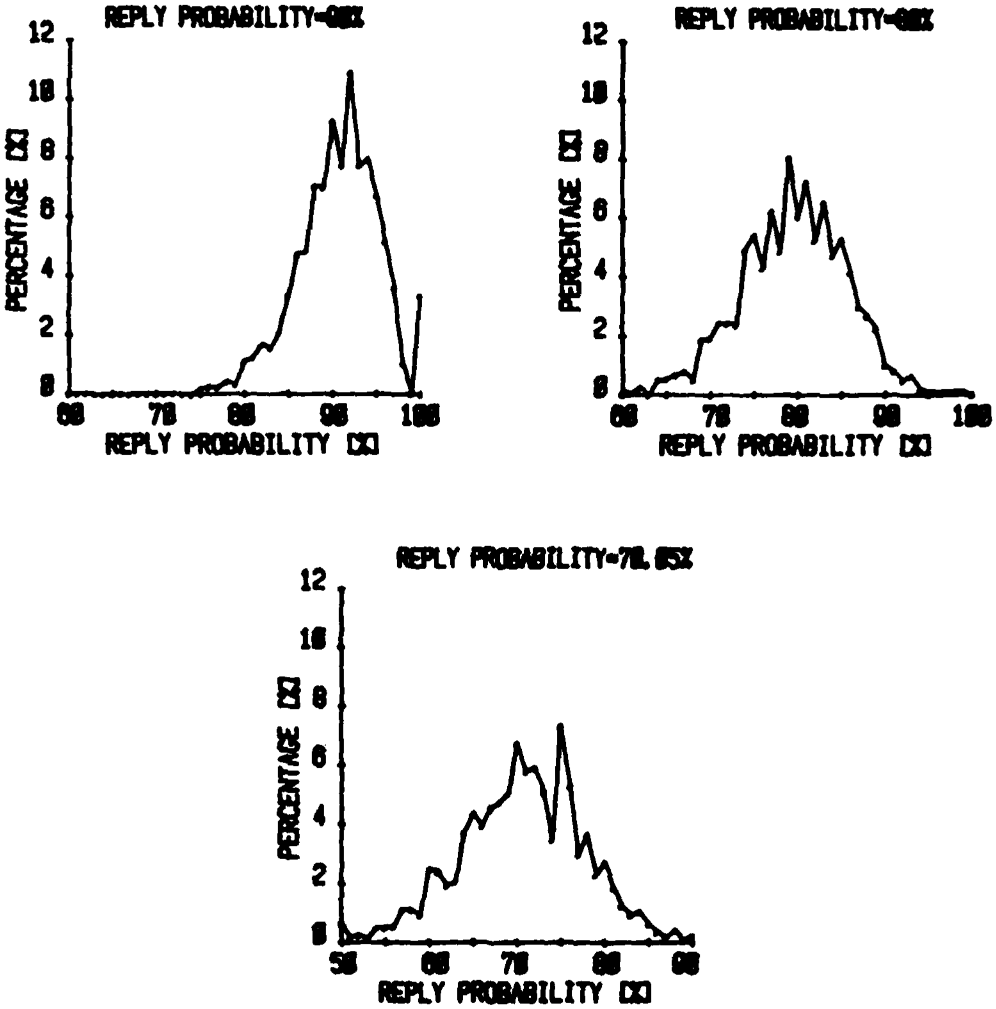
FIGURE 1. TERMINAL REPLY PROBABILITY DISTRIBUTION



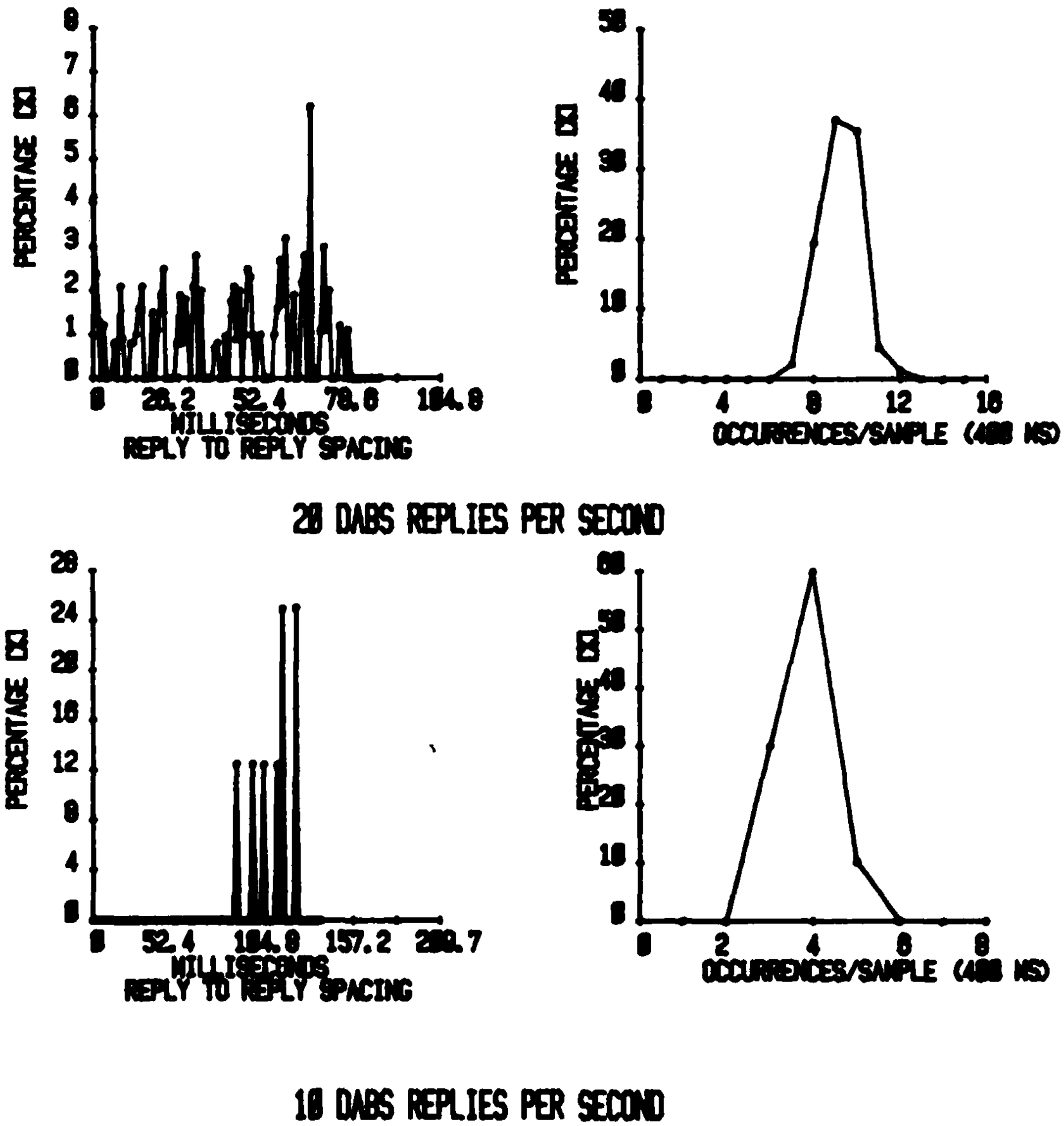
81-27-2

FIGURE 2. EN ROUTE REPLY PROBABILITY DISTRIBUTIONS

TABLE 1. DABS MESSAGE DISTRIBUTION

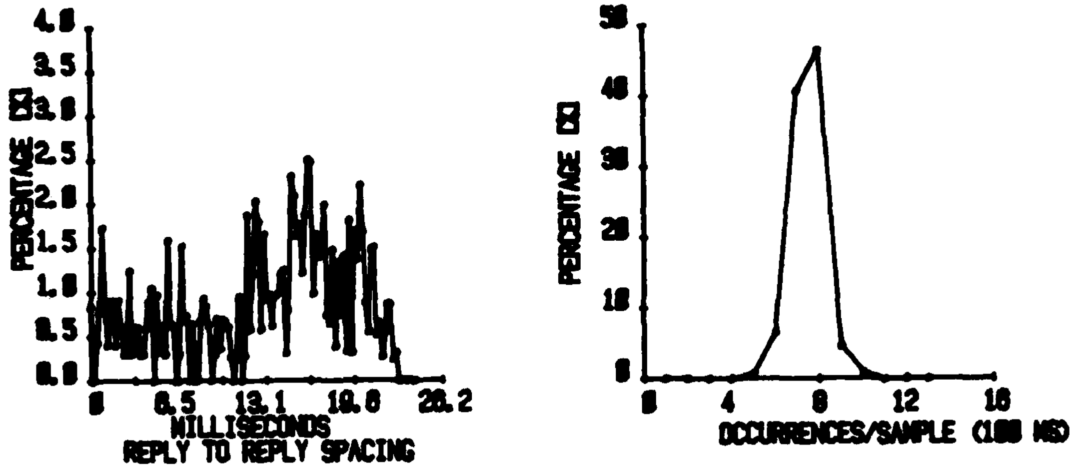
	DABS MESSAGE*	% CONTRIBUTION
1.	C54129854576AA	4.7
2.	D2B76C93B7071F	4.7
3.	D194F767E62E5A	4.7
4.	C94EAA98114897	2.3
5.	C62844CC6D1FF3	2.3
6.	C94E96AE868BDB	2.3
7.	00063A0920BF6F	9.4
8.	04031B748EDDA2	11.7
9.	CABC0621F88EC6	9.4
10.	008706C3ACD74F	4.7
11.	D64987A68526F3	4.7
12.	4A1C9AF54D16D7	4.7
13.	8C18FF3562E07F	4.7
14.	A74EAA9878AD9C	4.7
15.	40C4482690626C22862C89F70DC7	4.7
16.	447B3FFD507434C318BD8AB60A0	4.7
17.	CC89CA44AE84296AE694EC086484	3.1
18.	F3293657010488042957156F037E	3.1
19.	F319431644636490462132C2DA69	4.7
20.	F328411773839490299776A43006	4.7

*Message content listed in hexadecimal

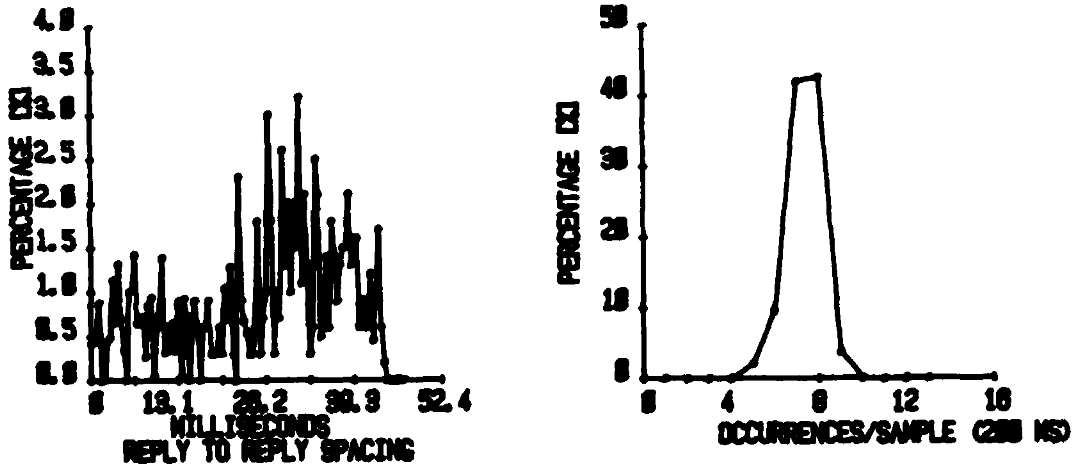


81-27-3

FIGURE 3. DABS FRUIT TIME DISTRIBUTIONS (10 AND 20 REPLIES)



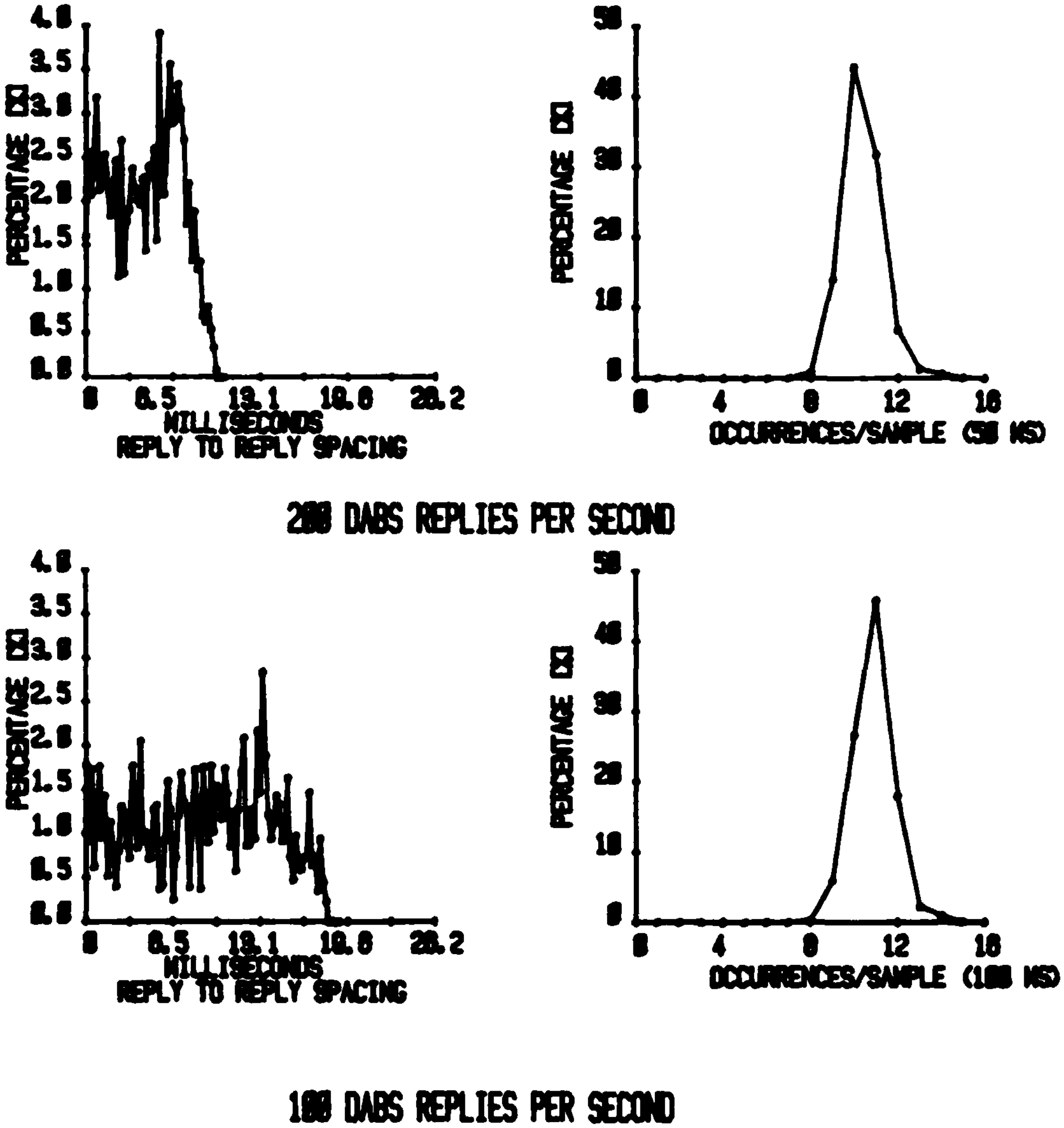
75 DABS REPLIES PER SECOND



40 DABS REPLIES PER SECOND

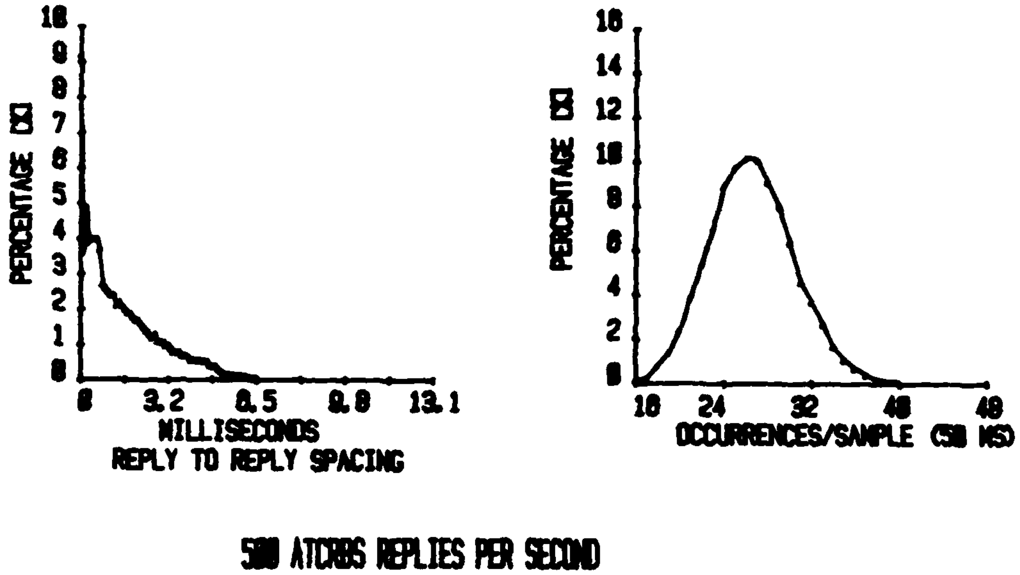
81-27-4

FIGURE 4. DABS FRUIT TIME DISTRIBUTIONS (40 AND 75 REPLIES)



81-27-5

FIGURE 5. DABS FRUIT TIME DISTRIBUTIONS (100 AND 200 REPLIES)



81-27-6

FIGURE 6. ATCRBS FRUIT TIME DISTRIBUTIONS (500 REPLIES)

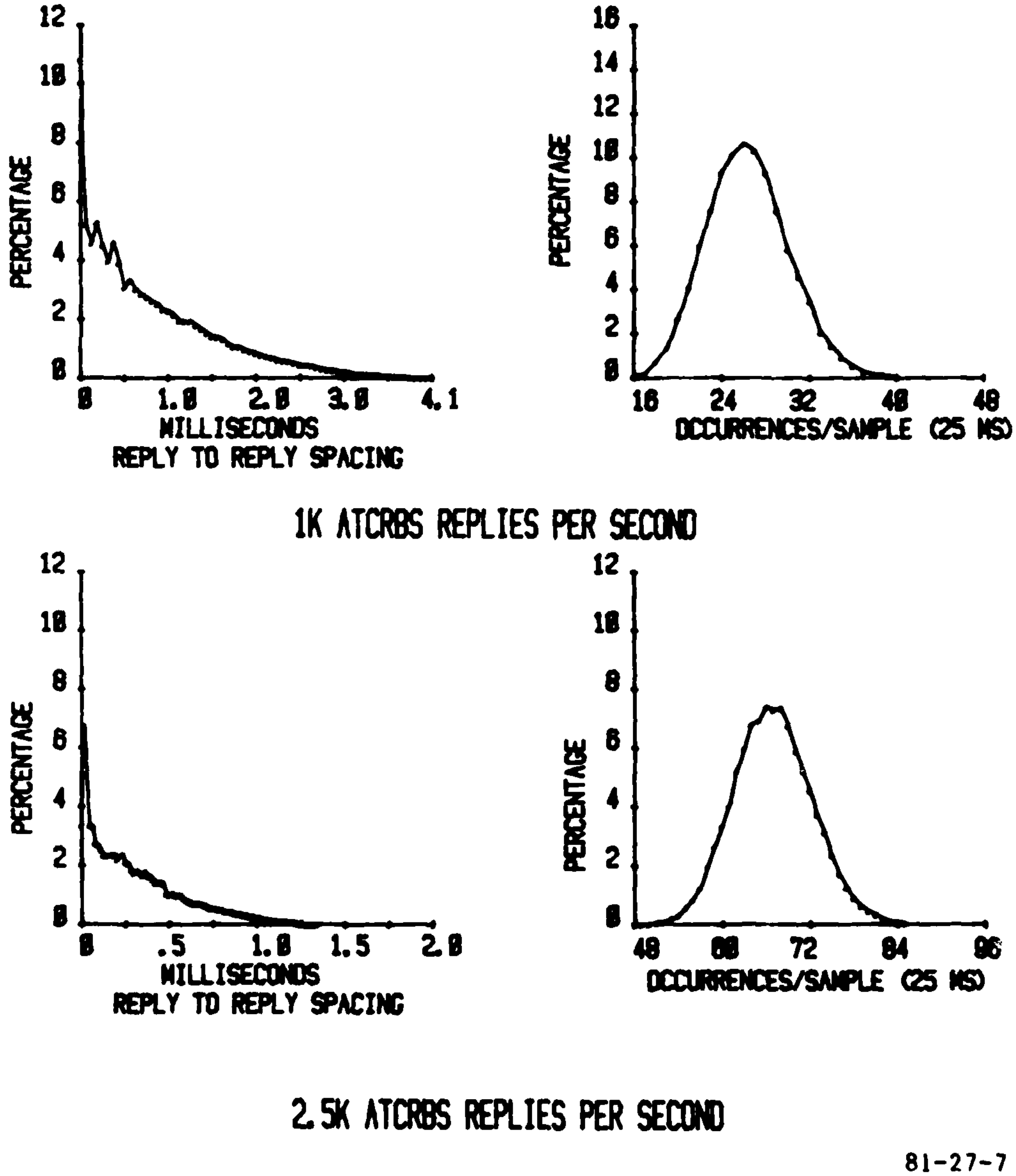


FIGURE 7. ATCRBS FRUIT TIME DISTRIBUTIONS (1,000 AND 2,500 REPLIES)

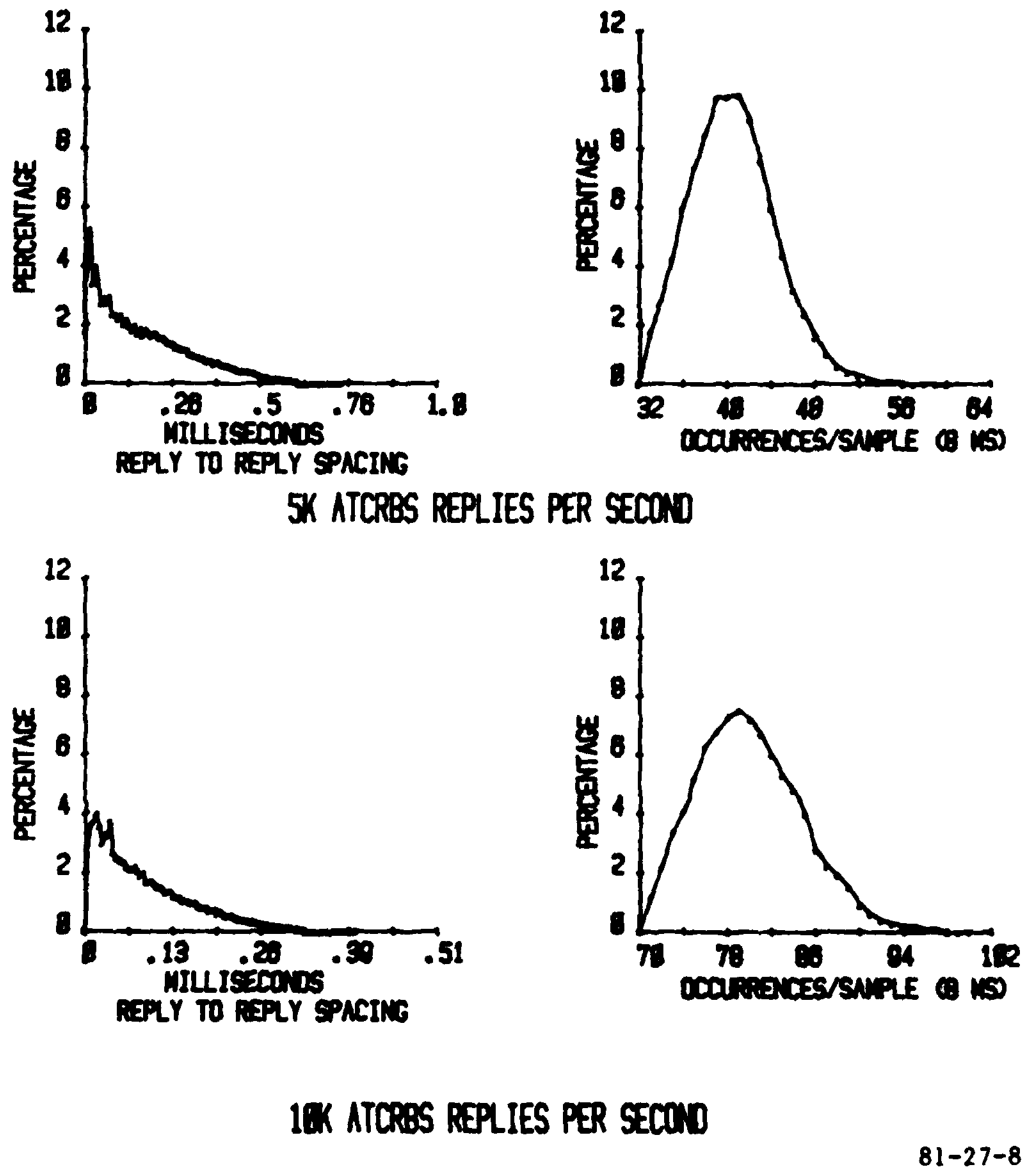


FIGURE 8. ATCRBS FRUIT TIME DISTRIBUTIONS (5,000 and 10,000 REPLIES)

TEST PROCEDURES AND RESULTS

ARTS III BDAS.

TEST CONFIGURATION. The system performance of the ARTS III BDAS in a DABS fruit environment was measured in terms of percent detection, false alarm, split rates, code validation, and system status information criteria. Percent detection, splits, false alarms, code validation, and status information data were collected for the 48 standard test input environments (eight DABS fruit rates versus six ATCRBS fruit rates) in three input configurations: undefruited video, defruited video, and undefruited video with a DABS preamble detector. To compare the performance of the BDAS at reply probabilities other than the 0.90 reply probability simulation used for the ATCRBS standard test environment, data were collected with defruited video at defruiter input reply probabilities of 1.00 and 0.80 at 200 DABS fruit per second.

The ARTS III BDAS was optimized in terms of system parameters at the FAA Technical Center during initial test and evaluation. The parameter selection was based upon optimization of target percent detection, target split rates, false alarm rates, and code validation. The detection parameter selections are listed and defined in table 2. As shown in table 2, the number of correlated "hits" or replies required to declare an in-process record (a possible target which has met the leading edge criteria) as a valid target is decreased by one for defruited video. A defruiter always eliminates at least one reply of a target. The parameter HY4R was, therefore, reduced from four replies to three replies for mode 3/A only targets, and from five to four for modes 3A and 3C aircraft targets for the defruited video compatibility tests.

A general block diagram of the BDAS DABS/ATCRBS compatibility tests is shown in figure 9. Azimuth, trigger, and video signals were generated by

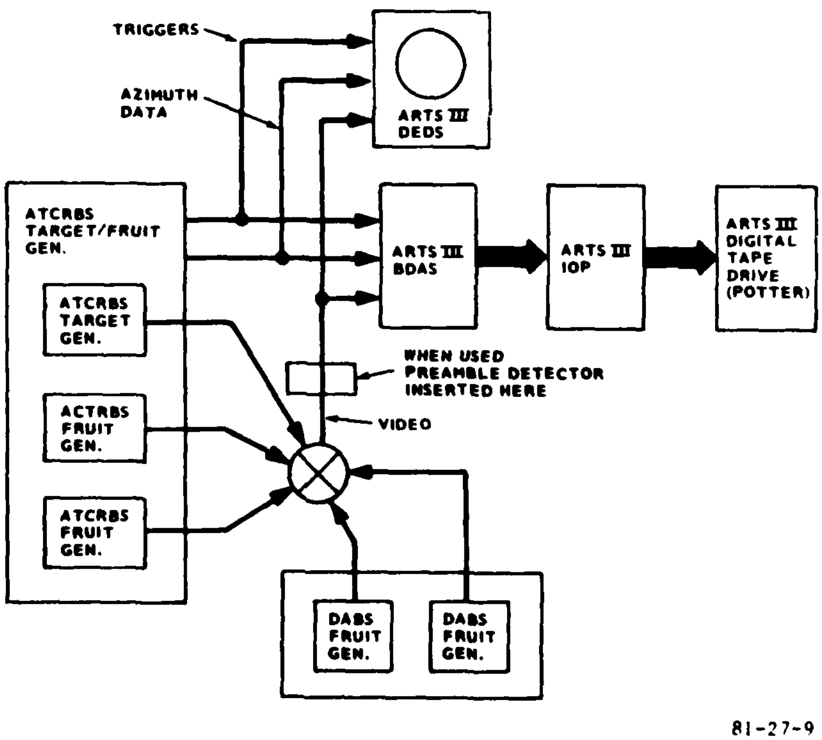


FIGURE 9. ARTS III TEST CONFIGURATION

TABLE 2. ARTS III DETECTOR THRESHOLD PARAMETERS

Parameter Notation	Description	Mode 3/A Parameter Values Detection Parameter Set No.			Mode C Parameter Values Detection Parameter Set No.		
		Undef.	Def.	Preamble Detector	Undef.	Def.	Preamble Detector
MY3	Number of consecutive misses prior to TL to discard a record as fruit	4	4	4	3	3	3
HY3	Number of hits required to declare TL	2	2	2	2	2	2
MY4R	Number of consecutive misses after TL to declare TT	4	4	4	3	3	3
HY4R	Minimum number of hits required to class a record as a valid target	4	3	4	5	4	5
RMRV	Minimum number of sweeps which must be observed before TT can be declared	15	15	15	15	15	15
TQY	Number of hits to declare a strong target	8	8	8	9	9	9

by the ATCRBS target/fruit generator and were input to the BDAS. The ARTS III Data Extraction program, a subprogram of the ARTS III operational program, was used to record on magnetic tape beacon target reports as detected by the IOP operational program and beacon processing status information monitored by the IOP. The status information includes percent IOP time required to perform beacon processing, Data Acquisition Subsystem (DAS) hardware alarms, report table overflow alarms, and IOP beacon input buffer overflow alarms. The percent of IOP time dedicated to beacon processing is a direct function of the input fruit rate and number of targets. The percent of IOP time available for beacon processing depends upon the functional loading of the IOP operational program. The IOP operational program at the TFAST facility, where the ARTS III BDAS compatibility tests were performed, contains beacon input and beacon target processing, tracking, keyboard input processing, and display updating. Field operational programs include additional available functions such as minimum safe altitude warning system (MSAW) or conflict alert which are not included in the operational program at the TFAST facility. These added functions reduce the available IOP time for beacon processing and, thus, reduce the system overload point.

The input buffer overflow alarm monitors the buffer of the IOP which receives parallel data from the BDAS hardware. An alarm is declared whenever the BDAS data buffer is full and cannot receive the data. BDAS hardware inputs azimuth words defining azimuth position, mode, and alarm information and reply words defining the range and code of detected replies. The IOP has two buffers to receive the BDAS input. One buffer receives data while the alternate buffer is being processed. Their functions are switched on a sweep basis. When the buffer receiving data is filled and a reply is received from the BDAS, an overload alarm is declared. The result of input buffer overflow is the random loss of replies. The buffer can hold 30 replies, which are received in range order (except for certain garble conditions). Therefore, the replies furthest in range have the most likelihood of being lost due to an overflow.

The report table overflow alarm was also monitored and recorded on magnetic tape. The report table contains the in-process records which attempt correlation with incoming replies. There are two buffers and on any given sweep, incoming replies are correlated with records in the active buffer and the updated records are switched to the alternate buffer. If no room exists in the buffer when attempting to start a new record or when transferring an updated record from the alternate buffer, an alarm is declared. The result of report table overflow is the loss of new or existing report records (these records are a history of a number of sweeps). A loss of a target record which was near completion will probably cause the target to go undetected. The minimum effect of a lost record is one lost fruit reply. The most drastic effect is the loss of a completed target. The loss is random in nature but records furthest in range are the most susceptible to an overload.

The BDAS hardware alarm was also monitored. This alarm is declared by the BDAS whenever the registers and buffer holding the replies in the BDAS hardware to be passed to the IOP are filled and another reply is received. This alarm is passed to the IOP by a bit indication in the azimuth word.

Extraction tapes of the collected data runs were processed by a reduction program written for the Digital Equipment Corporation (DEC) PDP-11/20 computer. The program provides target detection statistical summaries for percent detection, split rates, false alarm rates, range and azimuth accuracy, code validation data, run length, and hit count distributions.

Data are discussed in three parts: (1) data analysis for the undefruited video test configuration, (2) defruited video data, and (3) preamble detector data.

UNDEFRUITED VIDEO TEST ANALYSIS AND RESULTS. Results of the undefruited video percent detection measurements of the ATCRBS test targets as a function of the various DABS and ATCRBS fruit rates are given in appendix A, table A-1. The data shown are for an overall target reply probability of 0.90 from the statistical samples of the real world environment at the TFAST facility. The measure of degradation of percent detection for a particular DABS fruit rate and ATCRBS fruit rate is determined by comparing the result to the 0 DABS fruit result at the same ATCRBS fruit rate. This compares the ATCRBS/DABS test environment generated against the baseline ATCRBS test environment, thus, giving a measure of the effect due to the addition of DABS fruit. This determines the worst case effect since the replacement of ATCRBS with DABS will reduce the ATCRBS fruit rate. As shown by table A-1, the variation in results when comparing a DABS fruit data point against the equivalent baseline ATCRBS only shows slight variations by the injection of DABS. The measurement error of the percent detection data was found to be within approximately 1 percent. This measurement error was determined by comparing two exact runs of the baseline ATCRBS only environment. Therefore, any variations in the data less than 1 percent are statistically insignificant. The results indicate that there are no measurable effects on percent detection for DABS fruit rates of 200 per second and below. At 400 DABS fruit per second, a reduction of only 2 percent was measured at the 10,000 ATCRBS fruit rate with no measurable effects at lower ATCRBS rates. This 2 percent reduction was due to system overflows at the high fruit rates.

Splits were measured and averaged over 150 scans of data collection. Results for the undefruited video configuration at 0.91 target reply probability are shown in table A-2. The number of splits per scan varied as a function of increasing DABS fruit when compared to the equivalent baseline ATCRBS only result. This variation is encompassed by the measurement error. No degradation in splits can be measured at 75 DABS fruit per second or below at any of the ATCRBS fruit rates. Insignificant increases in the number of splits per scan can be seen at 100 DABS fruit per second and above.

False alarms per scan also increased slightly with increasing DABS fruit. DABS fruit alone injected into the 64 aircraft scenario does not cause false alarms. The baseline ATCRBS only environment data located along the top row of table A-3 shows no false alarms until 5,000 ATCRBS fruit per second. Adding DABS fruit to this environment slowly reduces the amount of ATCRBS fruit necessary to cause false alarms. No false alarms occurred at any DABS fruit rate under 1,000 ATCRBS fruit per second. The addition of DABS fruit at any ATCRBS fruit rate did not increase the false alarm rate significantly.

The code validation algorithm for the ARTS III processor establishes the reliability of the identity and altitude code declarations. Each of the 32 targets per ring contained the same identity and altitude code data. The declared codes for the targets were compared with the expected codes. The system operating with no fruit would be expected to declare the correct code with high validity. The system, when detecting the wrong code due to some interference, should assign a low code validity. The reduction program produced an output for the 150 scan extractions summarizing the number of detected targets with the correct codes and the respective validities, and the number of targets detected with an incorrect code and the respective validities. Code validation data for

undefruited video is summarized in tables A-4 and A-5. Except at 10,000 ATCRBS fruit per second, there is no measurable degradation of code validation through 400 DABS fruit per second. The number of good codes at validation level three at 10,000 ATCRBS fruit per second and 200 DABS fruit per second is reduced by approximately 2 percent. Incorrect code data is essentially unchanged from the baseline ATCRBS data through 200 DABS fruit per second. Two percent of correct codes with validation level of three at 0 DABS and 10,000 ATCRBS fruit per second were displaced to lower validation values when 200 DABS fruit per second was added. Most of the codes were reduced to validation levels of one and two, but the correct codes were maintained.

Tables A-6 through A-9 contain the compiled results of percent of IOP time for beacon processing, input buffer overflow alarms, report table overflows, and DAS hardware alarms. The results indicate that the injected DABS fruit increases the "loading" of the processor. The DABS fruit causes false fruit replies to be detected in the BDAS bracket detector and passed to the processor. ATCRBS brackets can be detected in a DABS reply by ATCRBS processors whenever two detected pulse leading edges in the DABS reply message are within the bracket detection tolerance. The BDAS hardware bracket detector declares a bracket whenever the leading edges of two pulses passing the quantizer amplitude and pulse width criteria (DABS pulses meet or exceed the pulse width requirement) are within 200 nanoseconds of 20.3 μs. The average number of ATCRBS replies detected and processed in a DABS reply can be determined by analyzing the percentage IOP time for beacon processing in table A-6. The percentage increase in processing time due to DABS alone is given in the left hand column of table A-6. The percentage processing time overhead for the 64 test targets alone is approximately 14.4 percent. The addition of 200 DABS fruit per second increases the percentage processing time percentage points 6.4 percent from 14.4 to 20.8 percent. Analyzing the percentage increase in processing time due to the addition of ATCRBS fruit, given in the top row of table A-6, shows that a 200 DABS fruit rate increases percentage processing time less than a rate of 1,000 ATCRBS fruit. The addition of 100 DABS fruit per second to the no fruit baseline environment is approximately equivalent to the addition of 500 ATCRBS replies per second. The indication is that an average of five brackets per DABS reply are transferred and processed by the ARTS III system. Tests were performed to determine the number of ATCRBS brackets generated by a bracket detector with ±100 and ±200 nanosecond tolerances using the 20 DABS messages programmed into the DABS fruit generator. The average number of brackets generated per DABS reply is a function of code and message length. With the various code selections and percentage mixture of long and short messages output by the DABS fruit generator to simulate a realistic environment, the average number of bracket declarations per DABS reply at a ±200 nanosecond bracket detection tolerance is approximately 25. This is far greater than the average number of ATCRBS replies processed from a single DABS reply by the ARTS system. The BDAS, therefore, does not process all the brackets declared by its bracket detector. The BDAS hardware will output to the IOP a maximum of two detected brackets in a 20.3 μs time interval. Many false brackets that normally would have been processed from a DABS reply are, therefore, ignored by the BDAS, lessening the interference potential of the DABS reply.

The input buffer overflow alarms in table A-7 indicate that the input buffer cannot handle 10,000 ATCRBS fruit per second. The amount of IOP time required for processing 10,000 ATCRBS fruit per second (86.1 percent) is beyond the

processor design limits. Input buffer overflows occur at 5,000 ATCRBS fruit per second when DABS fruit is injected. The number of input overflows at 5,000 ATCRBS fruit per second and below, with the expected maximum DABS fruit rate of 100 per second, is approximately one per scan. This means that one test target reply out of every complete scan in the test scenario may possibly be lost due to the input buffer overflow. This represents a maximum reduction in reply probability (of the 64 target scenario) of 0.09 percent, based upon an average of 18 replies per target. The DAS hardware alarm occurred at 2,500 ATCRBS and 200 DABS fruit per second (one instance out of 150 scans). This alarm is dependent upon the bunching in time of replies to be passed to the IOP. The distribution of the 2,500 ATCRBS and 200 DABS fruit per second at one particular instance caused the alarm. This instantaneous loading did not occur with 200 DABS and higher ATCRBS fruit rate. The most detrimental system alarm is the report table overflow. As shown by table A-9, these alarms occur at an ATCRBS fruit rate of 10,000 fruit per second. No report table overflows occurred below 10,000 ATCRBS fruit per second at any DABS fruit rate except at 5,000 ATCRBS and 200 DABS fruit per second. This is over twice the expected maximum DABS fruit rates.

<u>DEFRUITED VIDEO TEST RESULTS</u>. Most of the field terminal ARTS III systems utilize defruited video. The function of a defruiter is to eliminate non-synchroneous fruit replies from the input video. Therefore, the false bracket detections caused by DABS replies should also be eliminated by the defruiter. The standard measured live reply probability of 0.90 was input to the defruiter for the 42 DABS/ATCRBS test environments.

The results of percent detection as a function of DABS and ATCRBS fruit are shown in table A-10. There is no measurable degradation in percent detection by the addition of DABS fruit at any ATCRBS fruit rate. Splits per scan and false alarms per scan are given in tables A-11 and A-12, respectively. There is no measurable increase in splits per scan as a function of DABS fruit rate. False alarms per scan are increased slightly by the addition of DABS fruit. At 10,000 ATCRBS fruit per second, a very slight increase in false alarms occurs at 100 DABS fruit per second and above. False alarms are nonexistent at all ATCRBS fruit rates of 5,000 and below, except at 200 DABS fruit per second. False alarms occur (1 out of 150 scans) at 2,500 ATCRBS and 200 DABS fruit per second. In general, false alarms do not occur at any DABS fruit rate at or below the worst case when a defruiter is implemented. The defruiter effectively eliminates false alarms.

Tables A-13 and A-14 contain the percentage IOP time for beacon processing and the overload alarm data. The percentage IOP time data verifies that the false ATCRBS replies previously detected by the BDAS are eliminated by the defruiter. The percent IOP time for beacon processing at 200 DABS fruit per second without ATCRBS fruit is the same as a no fruit environment. At 10,000 ATCRBS fruit, defruiter breakthrough causes a slight increase in the percent of IOP time for beacon processing. The addition of DABS fruit to 10,000 ATCRBS fruit per second causing defruiter breakthrough increases the percentage IOP time slightly as well. There were no detected overload alarms at any DABS and ATCRBS fruit rate.

The code validation data for defruited video is given in table A-15 and A-16. The percentage of correct codes with validation level of three did not decrease significantly with the addition of DABS fruit. Only at 200 and 400 DABS fruit per second is there a slight noticeable difference in the percentage (1.1 percent at 200 DABS and 10,000 ATCRBS fruit per second). In general,

the effect of DABS is eliminated when implementing a defruiter.

Data were collected to analyze the effect of reduced reply probability on the performance of the BDAS when DABS fruit is injected. The data presented thus far, is at a reply probability of 0.90, the overall average reply probability of the statistical samples of the live environment at the TFAST facility. Reply probabilities of 1.00, 0.90, 0.80, and 0.70 are presented in figures 10, 11, and 12 for percent detection, splits, and code validation. Percent detection and splits show no measurable effect due to the addition of 200 DABS fruit at any ATCRBS fruit rate at the above reply probabilities. Code validation is affected very slightly by the addition of 200 DABS fruit per second at the higher ATCRBS fruit rates, although the decrease is not a function of reply probability. In general, percent detection and code validation are reduced as reply probability is reduced. As expected, splits increase as reply probability is reduced.

PREAMBLE DETECTOR TEST RESULTS. The preamble detector was designed to eliminate DABS replies from the input beacon video. This is accomplished by detection of the DABS four pulse preamble. With proper operation, all the data collected with the preamble detector with the various DABS fruit rates should closely match the ATCRBS only environment.

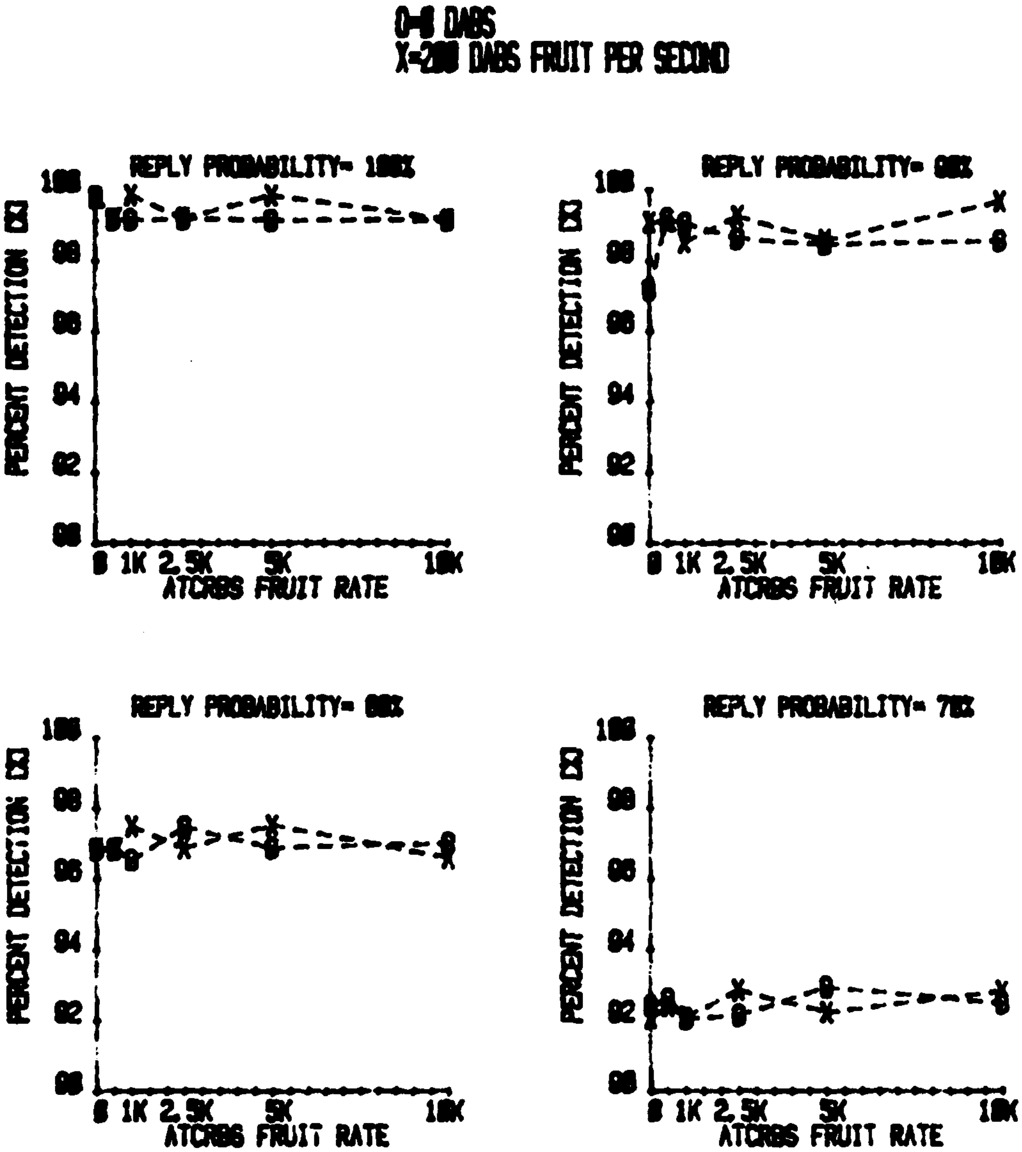
The percent detection, split, and false alarm data when implementing a preamble detector is given in tables A-17, A-18, and A-19. The data verifies that at all DABS fruit rates the results are similar to the baseline ATCRBS only environment at the same fruit rate.

Table A-20 verifies that the percentage IOP time for beacon processing is the same as the baseline ATCRBS only environment for the given ATCRBS fruit rate at any DABS fruit rate. Tables A-21, A-22, and A-23 contain the alarm data. An interesting phenomena can be seen in the input buffer overflow data. The number of overflows per scan at 10,000 replies per second decreased as DABS fruit was increased. The ATCRBS replies that occurred during a DABS message were lost. The probability of an ATCRBS reply and a DABS reply overlapping is higher at the higher fruit rates. The preample detector eliminated the ATCRBS replies overlapped with the DABS replies decreasing the amount of replies the BDAS must process. The code validation data shown in tables A-24 and A-25 verify that the DABS fruit results match the baseline ATCRBS only results for all DABS fruit rates.

One advantage of the preamble detector is that it will eliminate the increase in the processor loading that the addition of DABS fruit will have on the processor in the undefruited video configuration. Also, the display integrity of the beacon video is maintained by implementation of a DABS preamble detector.

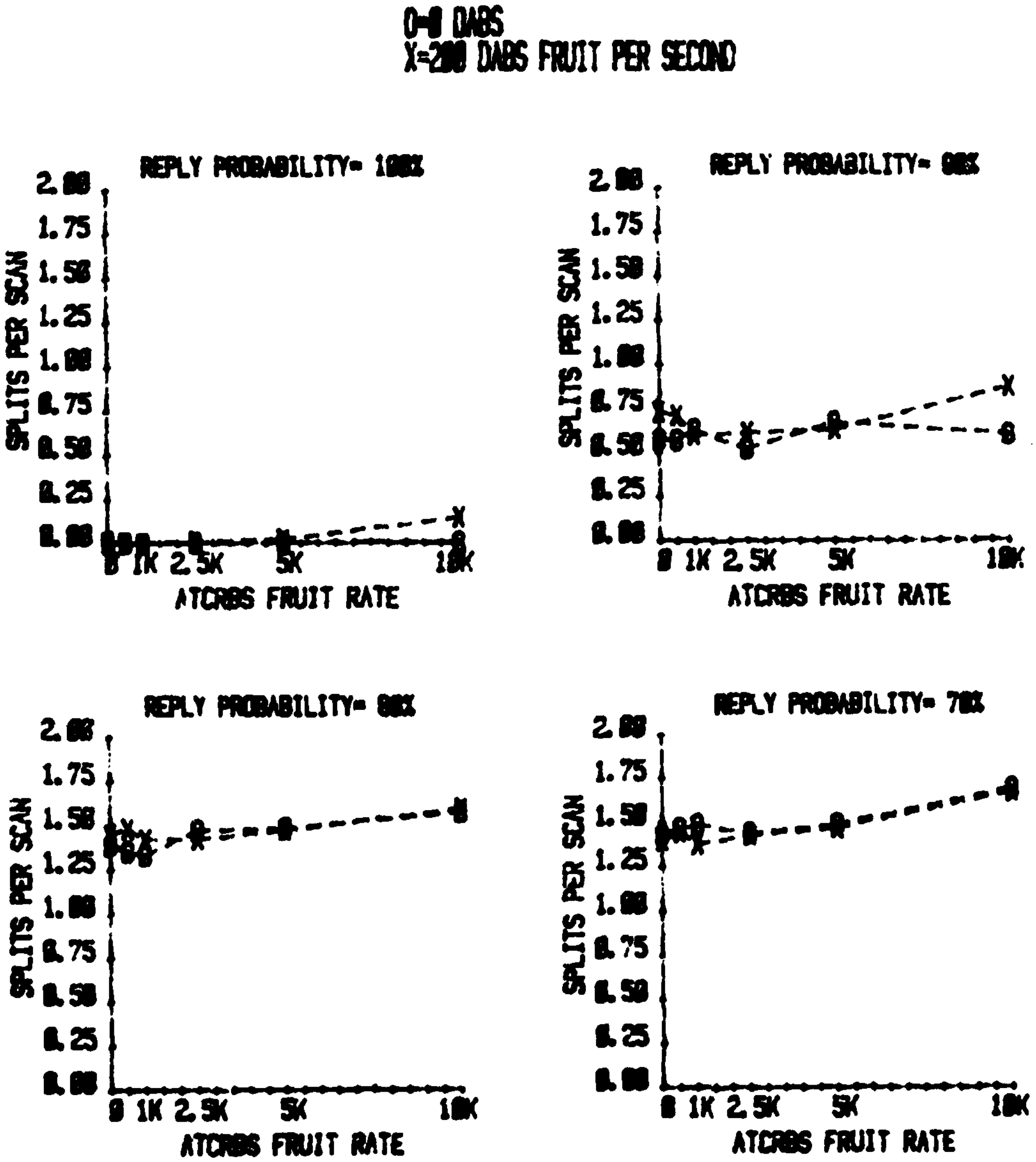
SRAP TEST CONFIGURATION AND DATA RESULTS.

The SRAP is a radar and beacon processor consisting of two microcomputers to perform radar and beacon processing. It will be incorporated into the present ARTS III systems replacing the ARTS III BDAS hardware and decreasing the functions of the ARTS III IOP. The present ARTS III consists of the BDAS hardware which detects ATCRBS replies from the beacon input video and passes to the IOP all reply and positional information. The IOP performs all reply correlation and target report processing. The SRAP will perform all reply correlation and target report processing and output detected target reports to the IOP. The beacon portion of the SRAP consists of a hardware unit to detect the ATCRBS replies and a microcomputer to perform reply correlation and target processing presently done by the IOP.



81-27-10

FIGURE 10. ARTS III BDAS PERCENT DETECTION



81-27-11

FIGURE 11. ARTS II BDAS SPLITS

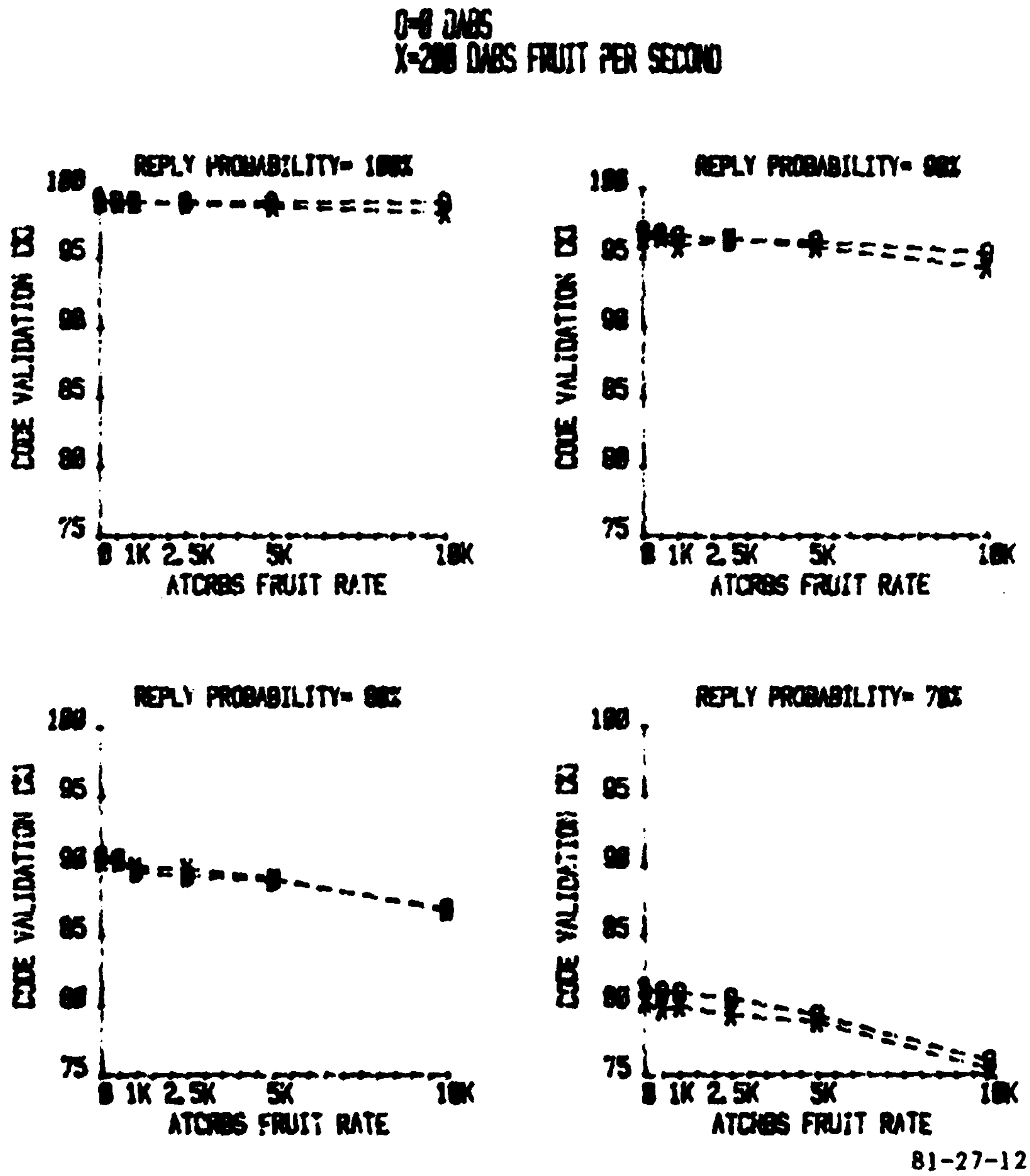


FIGURE 12. ARTS III BDAS CODE VALIDATION WITH CORRECT CODE

A block diagram of the test configuration for the SRAP is shown in figure 13. The ATCRBS target/fruit generator supplied all trigger and video signals to drive the SRAP. Beacon target reports, azimuth, and status information generally sent to the IOP was monitored on-line. Percent detection, splits, false alarms, code validation, and system overload analysis were performed on-line via a reduction program for a DEC LSI-11LO3 minicomputer. The SRAP was tested in three test input configurations: undefruited video, defruited video, and undefruited video with a DABS preamble detector. The target detection parameters in the SRAP were modified according to the test configuration. The selectable parameter functions and their values are shown in table 3. The undefruited video parameter values were used for the tests with the DABS preamble detector as well.

The collected data reduced on-line included SRAP alarms indicating beacon processing overloads. Beacon replies are detected in hardware and input to a microcomputer to perform target detection. The SRAP BDAS utilizes a 64 word input first-in first-out (FIFO) buffer to temporarily store replies, alarms, and azimuth data from the hardware to input to the beacon microcomputer. The 64 word FIFO allows a maximum buffering of 32 replies (2 words per detected reply), assuming no other message type occurred.

The loss of information due to an overload is at least one reply. All replies lost due to a single FIFO full alarm are within a single sweep, so no more than one reply of a particular target can be lost due to a single FIFO full alarm.

The second alarm monitored for the compatibility tests were record store

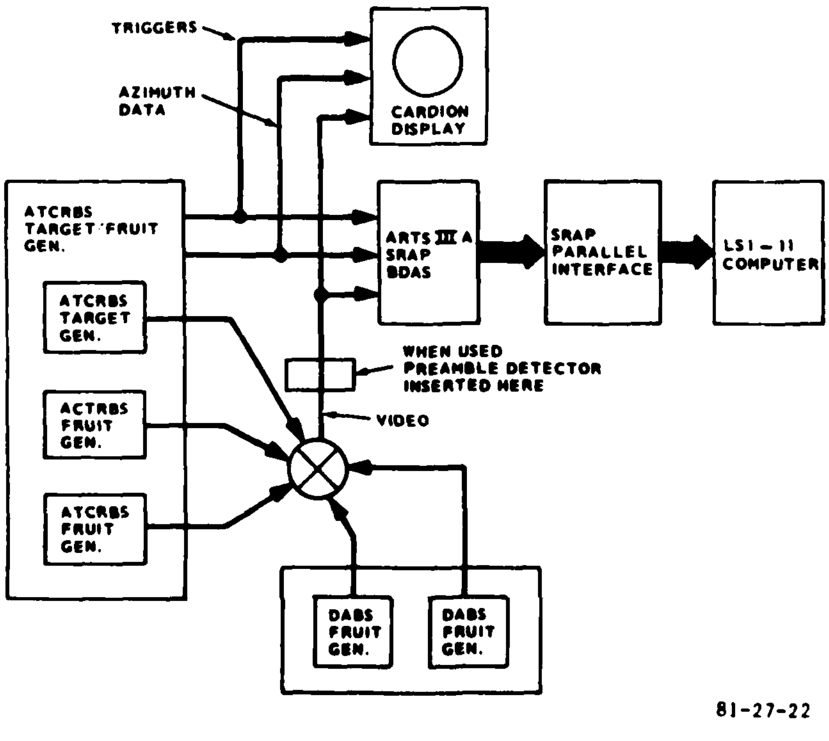


FIGURE 13. ARTS IIIA SRAP TEST CONFIGURATION

TABLE 3. SRAP DETECTION PARAMETER SELECTIONS

Parameter Notation	Description	Undefruited/ Preamble Det.	Defruited
HT	Number of hits required to classify a 3A/C mode record as a valid target	4	3
CHT	Number of hits required to classify a 3A only mode record as a valid target	3	3
MT	Number of consecutive misses after TL to declare TT	6	7
MST	Minimum number of sweeps which must be observed before TT can be declared	10	9
CT	The number of range cells (103.5 nanoseconds) within which to correlate a reply to a target record	4	4
NRSC	The number of sweeps a target must be in process in order to begin a new target record when a 3A code of a received range correlated reply does not match the 3A code of a mode 3A validity 3-target record	14	14

table overflows. All replies input to the microcomputer from the front end hardware are either eliminated as a phantom reply, range correlated to an existing record, or used to begin a new record in the active record store table. There are two record store table buffers with the capability of storing 45 records each. On any one sweep, one buffer accepts new and updated records and the alternate buffer contains the in-process records from the previous sweep. When storage in a buffer is attempted while the buffer is filled, an overload alarm is declared. The loss due to a record store table overflow is any succeeding records in range after the occurrence of the overflow and any succeeding replies detected on the present sweep.

The amount of information lost due to the overflows is random in nature, but since the correlation process is range ordered, the replies and records furthest in range have more likelihood to be affected by an overflow.

The results are presented and discussed in four sections: the undefruited video results, defruited video, and undefruited video with a DABS preamble detector. The fourth section determines the performance of the SRAP at the lower reply probability in a DABS fruit environment in the undefruited, defruited, and preamble detector configurations.

<u>SRAP — UNDEFRUITED VIDEO RESULTS.</u> The SRAP was evaluated in a DABS fruit environment by determining the percent detection and split rates of the 64 test targets of the simulated environment. The percent detection and split rates are given in tables A-26 and A-27,

respectively. The percent detection results indicate that the baseline ATCRBS environment percent detection is very good. The addition of DABS fruit has very little measurable effect on the percent detection of the test targets until DABS fruit rates of 100, 200, and 400 per second. At 200 DABS and 10,000 ATCRBS fruit per second the degradation is approximately 1.5 percent. The split data indicates that splits are nonexistent in the baseline ATCRBS only environment until 10,000 ATCRBS fruit per second. Splits occur at lower ATCRBS fruit rates with the addition of DABS fruit. At 0 ATCRBS fruit per second splits occur at 100 DABS fruit per second. The increase in splits due to DABS fruit is very slight.

The false alarm data are given in table A-28 as a function of DABS and ATCRBS fruit. False alarms increase slightly with the addition of DABS fruit; the largest increase is at 10,000 ATCRBS fruit per second.

Code validation data are presented in tables A-29 and A-30 for the percentage correct codes detected and incorrect codes detected for the 64 test targets. The percentage correct codes with validation level of three decreases slightly due to the addition of DABS fruit. The addition of 200 DABS fruit per second at 10,00 ATCRBS fruit per second decreases the percentage of correct codes with validation level three by only 0.6 percent. The largest effect is at 400 DABS and 10,000 ATCRBS fruit per second wich reduces the number of correct codes with validation level 3 by 2.12 percent.

The input FIFO full alarm and record table overflow data are shown in tables A-31 and A-32, respectively. The data indicates that input FIFO full alarms occur as a result of the addition of DABS fruit. At the lowest DABS fruit rate of 10 per second, input FIFO full alarms occur. The effect of DABS on the input FIFO full alarm is due to the number of brackets generated from the DABS reply. SRAP hardware passes all detected brackets from the input video to the beacon microcomputer since all garble detection and phantom reply elimination is performed by the microcomputer. Record table overflow alarms do not occur in an ATCRBS only environment. The addition of 10 DABS fruit per second to 10,000 ATCRBS creates the overflow alarm. As mentioned before, input FIFO full alarms will cause loss of reply information. The number of replies lost is a function of how many and the time distribution of the replies that were detected on the particular sweep the overflow occurred. The record table overflow causes the loss of any records that were not as yet switched to the alternate buffer by the overflow or by any detected reply after the overflow on the particular sweep the overflow occurred.

DEFRUITED VIDEO. The SRAP was tested with a defruiter to determine if the injection of DABS fruit affects performance. The percent detection, split, false alarm, and code validation data are shown in tables A-33, A-34, A-35, A-36, and A-37, respectively. The results indicate that the DABS fruit has little or no affect upon percent detection, splits, and code validation. Code validation at 10,000 ATCRBS and 200 DABS fruit per second is down slightly by 0.42 percent from the baseline 10,000 ATCRBS fruit per second result. SRAP alarm data are presented in tables A-38 and A-39. Input FIFO full alarms did not occur until 100 DABS fruit per second, which is the maximum expected fruit rate. No record table overflow occurred at any DABS fruit rate.

PREAMBLE DETECTOR. The preamble detector data are shown in tables A-40 through A-44. The data for splits, false alarms, percent detection, overflow alarms, and code validation verifies that the preamble detector eliminates any effect due to the addition of DABS fruit. All data

match the baseline ATCRBS test environment results. All the processing overflows previously measured in the undefruited video configurations were eliminated at all DABS fruit rates when implementing the preamble detector.

Tests were performed to determine if the addition of DABS fruit in a lower reply probability environment would degrade the system performance. Data were collected for percent detection, splits, code validation, and azimuth accuracy for all three input configurations for baseline (0 DABS) and 200 DABS fruit per second at 0, 500, 1,000, 2,500, 5,000, and 10,000 ATCRBS fruit per second. The results are shown in figures 14, 15, 16, and 17. The equivalent results of the measured real world environment reply probability at the TFAST facility of 0.90 are included in the figures for comparison. The percent detection results in figure 14 verifies that defruited video percent detection is most sensitive to reduction in reply probability.

The comparison of defruited video baseline percent detection to that of 200 DABS fruit per second percent detection shows little variation. The same is true for the preamble detector percent detection. Undefruited video percent detections are reduced slightly by the addition of 200 DABS fruit per second. As shown by figure 14, the undefruited video baseline percent detection results match the baseline preamble detector percent detection results at all ATCRBS fruit rates. The preamble detector and defruited video percent detection data at 200 DABS fruit per second match the baseline data at both reply probabilities. The reduction in percent detection of the undefruited video configuration is slightly higher at the 0.70 reply probability.

The split data in figure 15 verifies the same phenomenon; defruited video is most sensitive to the reduction in reply probability. In the undefruited video configuration, the addition of 200 DABS fruit per second causes an insignificant increase in splits. The preamble detector and defruited video split data remained the same when DABS fruit was added.

Figure 16 contains the reply probability comparison data for code validation. The percentage of correct code with validation level three are shown. As indicated by the data, even at 0.90 reply probability, defruited video code validation is less than the equivalent undefruited and preamble detector data points. However, there is no measurable difference at the two reply probabilities between the baseline data and the 200 DABS fruit per second data for defruited video. The same is true for the preamble detector and undefruited video data at 0.90 reply probability. The percent of correct codes with code validation level three for undefruited video at 0.70 reply probability is slightly less due to the addition of 200 DABS fruit per second.

Azimuth deviation data was collected for undefruited video, defruited video, and preamble detector processed video. Azimuth deviation was measured by comparing the expected center azimuth to the reported center azimuth for the 64 test targets. Azimuth is calculated in the SRAP by a center of density technique, which adds a weighted value to a running sum for each sweep a reply is received for a target. The azimuth deviation data is presented in figure 17. The data verifies that undefruited video has far better azimuth accuracy than defruited video for all ATCRBS fruit values. Azimuth accuracy is far better for undefruited video than defruited video at 200 DABS fruit per second. However, the defruited video azimuth accuracy is not affected by the addition of DABS; whereas, the undefruited azimuth accuracy is degraded slightly. The preamble detector azimuth accuracy is unchanged from the baseline results when 200 DABS fruit per second

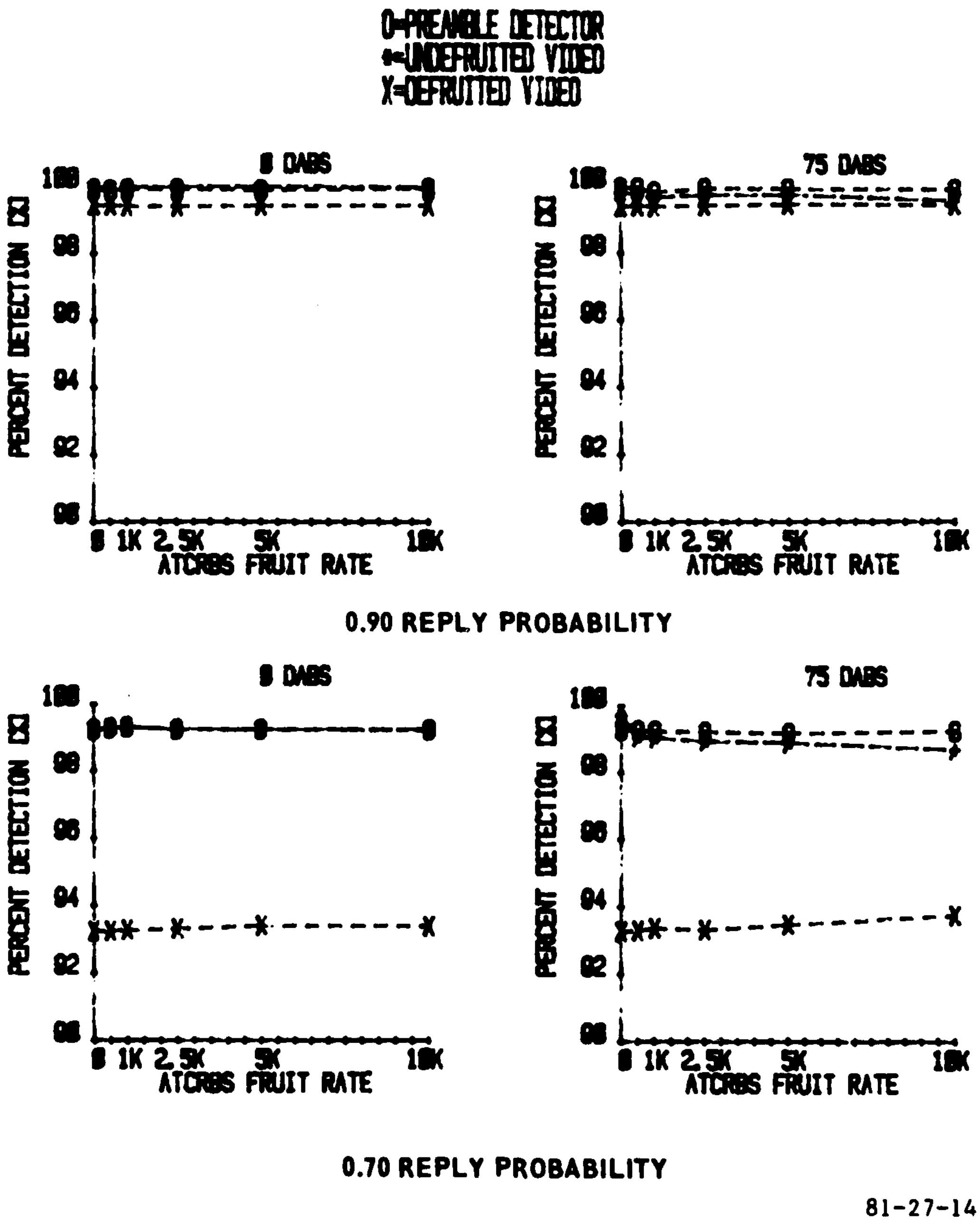


FIGURE 14. SRAP PERCENT DETECTION

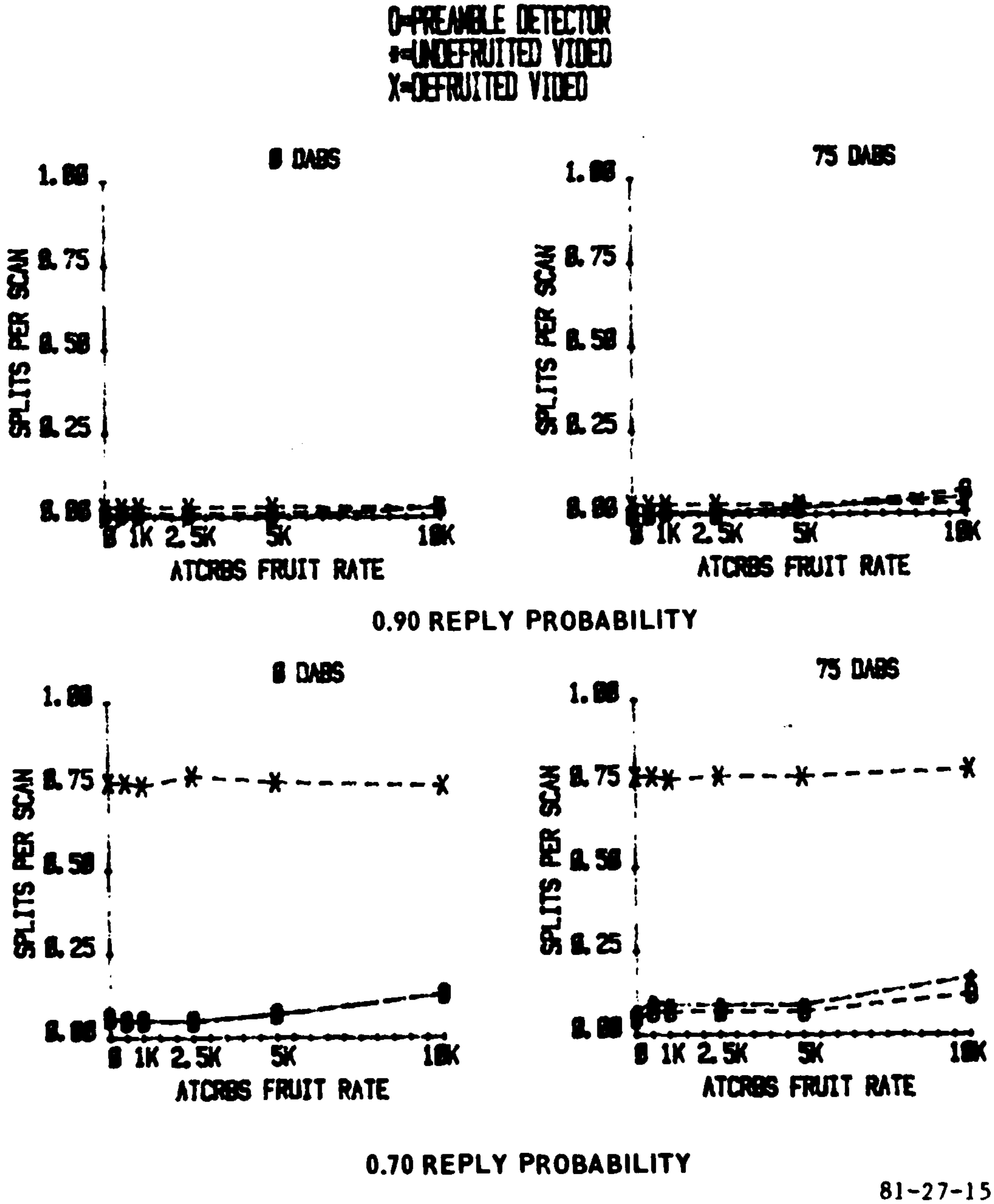


FIGURE 15. SRAP SPLITS

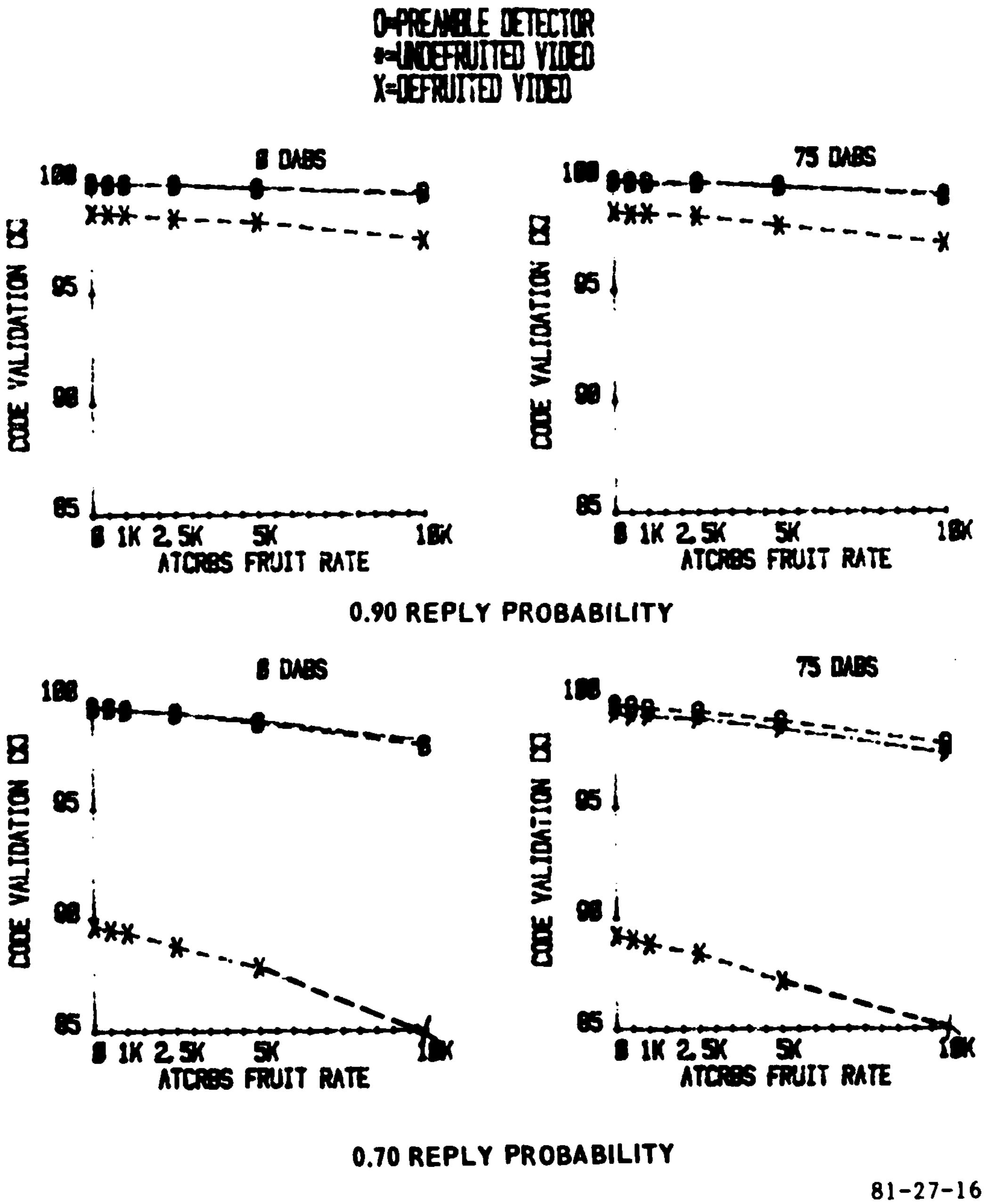
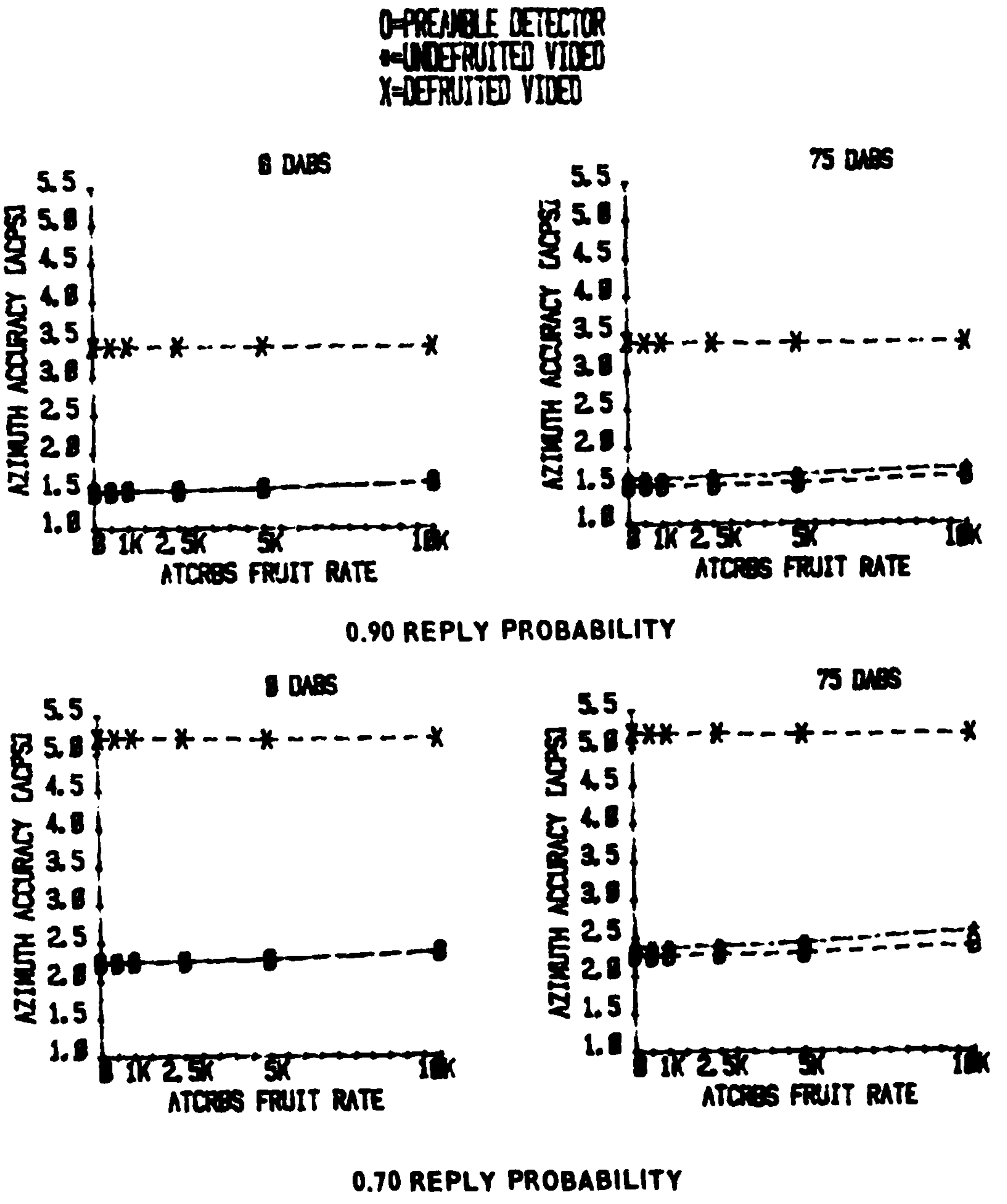


FIGURE 16. SRAP CODE VALIDATION WITH CORRECT CODE



81-27-17

FIGURE 17. SRAP AZIMUTH ACCURACY

is added and matches the undefruited video 0 DABS fruit results.

ARTS II.

TEST CONFIGURATION. The ARTS II system is an automated ATCRBS processor for terminal beacon processing. The ARTS II systems employ defruited video, so all tests were run with defruited video. Since a standard did not exist for the detection parameter selections in the system, several test runs were performed with various parameter values to optimize the system in an ATCRBS environment. The simulated environment used was the baseline 64 test target configuration for the compatibility testing with ATCRBS fruit rates of 0, 500, 1,000, 2,500, 5,000, and 10,000 and input reply probability of 0.90. The detection parameters in the ARTS II are all software dependent. Target detection processing is performed by the minicomputer. The detection technique is a 16-bit "sliding window" which is a 16-sweep history of a target record. Detection parameters are target leading edge threshold (TL), target validation threshold (TV), and target trailing edge threshold (TT). A target record is declared in-process when the 16-bit sliding window sum equals TL. TV is the value of the window sum which begins code validation on the target record. Target trail edge is declared when the window sum equals TT.

Various values of TL, TT, and TV were run to achieve the optimum in terms of percent detection, splits, false alarms, and code validation criteria. The values selected were: TL = 3, TT = 2, and TV = 2.

RESULTS. The ARTS II system was tested in the configuration shown in figure 18. The data were recorded on magnetic tape and reduced by a reduction program written for the DEC PDP-11/40. The results for percent detection, splits, and code validation are shown in tables A-45, A-46, A-48, and A-49, respectively. There is no measurable

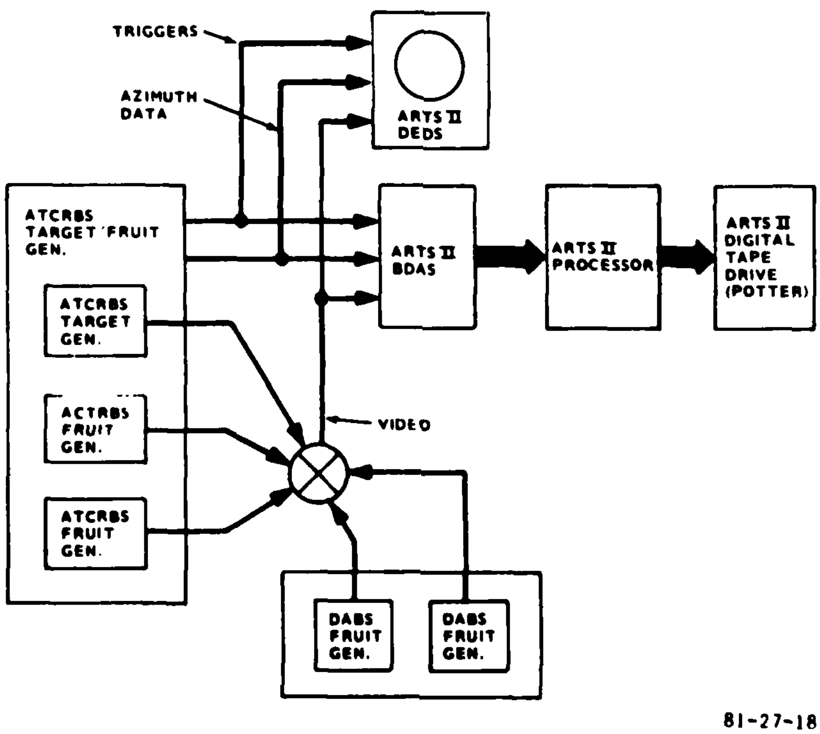


FIGURE 18. ARTS II TEST CONFIGURATION

degradation to percent detection, splits, or code validation as indicated by the data. False alarm data shown in table A-47 indicate a slight increase in false alarms at 5,000 and 10,000 ATCRBS fruit per second as DABS fruit is increased. Processor overload alarms were monitored via teletype for the tests and no alarms were reported by the system.

To verify that DABS fruit would not affect the ARTS II system performance in an environment with reduced reply probabilities, several runs were performed with various reply probabilities at 0 DABS and 200 DABS fruit per second. Reply probabilities tested were 1.00, 0.90, 0.80, and 0.70. The data are shown in figures 19, 20, and 21 for percent detection, splits, and code validation. Results indicate no measurable effect with the addition of 200 DABS fruit per second. Code validation data show a slight reduction in good codes with validation level three at the lower reply probabilities of 0.80 and 0.70 with DABS fruit.

AN/TPX-42.

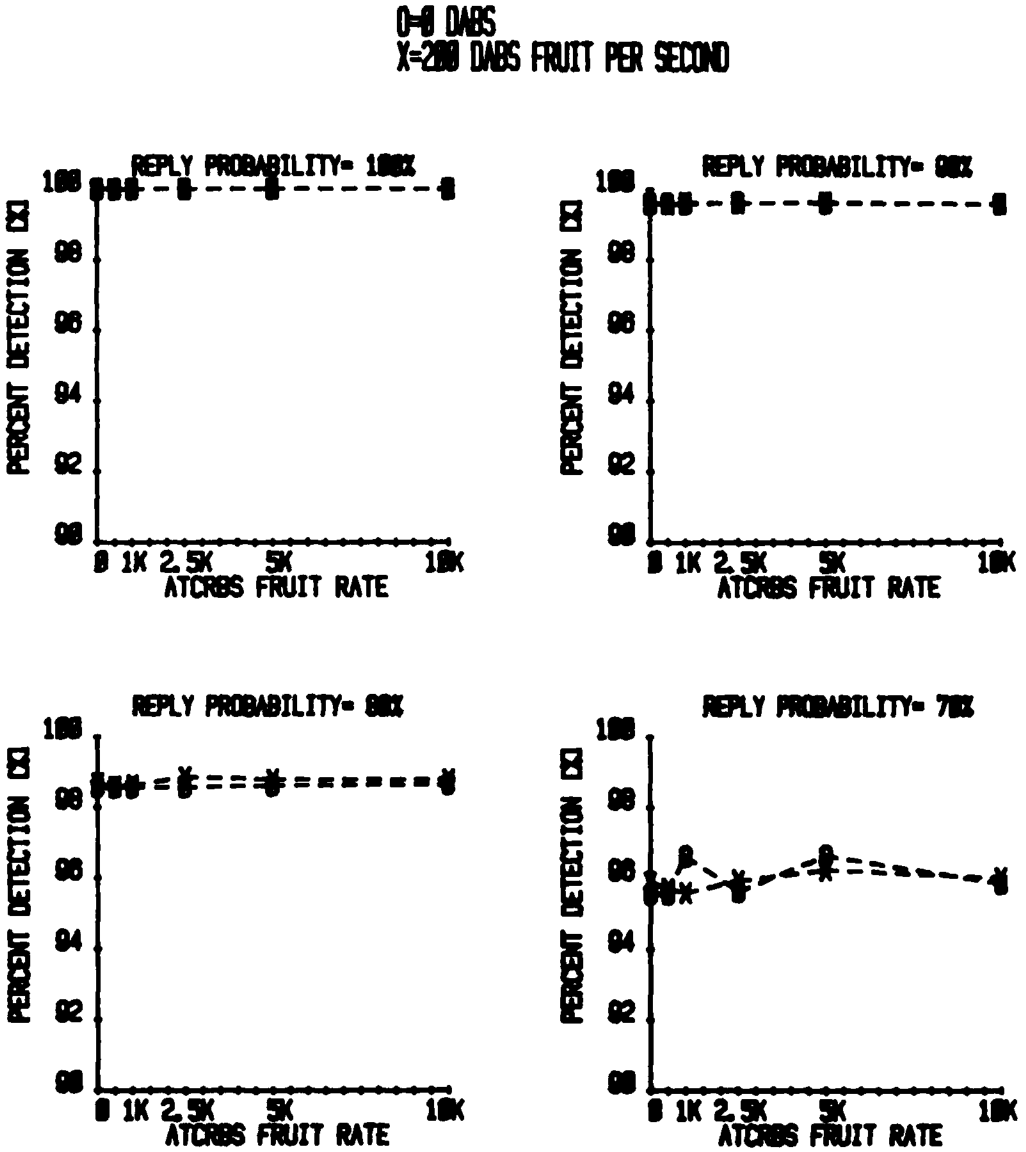
The AN/TPX-42 is a hardware type ATCRBS detector and processor. It has limited capacity as far as display and processing capability and is generally installed at low density terminal facilities. The AN/TPX-42 has a sliding window type detector, basically the same as the en route common digitizer. Switch settings select the window size, the number of range correlated replies to declare a target (TL), the number of replies in the window after TL to declare the trail edge of a target (TT), and the number of replies in the window required to begin code validation (TV).

The test configuration for the AN/TPX-42 compatibility tests is shown in figure 22. Tests were conducted with defruited video. The system was optimized in terms of detection parameters by conducting optimization runs with the baseline ATCRBS only test environment with fruit rates from 0 to 10,000 ATCRBS fruit per second. The optimization criteria was the best overall performance in terms of percent detection, splits, false alarms, and code validation. The optimum setting was determined to be: TL = 2, TT = 1, TV = 3, and a sliding window width of 10 sweeps.

The AN/TPX-42 compatibility data are presented in tables A-50, A-51, A-52, A-53, and A-54 for percent detection, splits, false alarms, and code validation. The percent detection data in table A-50 verifies that there are no measurable degradation in percent detection for all DABS fruit rates. Also, percent detection is not affected by the addition of ATCRBS fruit. Splits and false alarms are also immune to DABS fruit. Code validation data are given in tables A-53 and A-54.

Code validation in the AN/TPX-42 is a 1-bit field indicating that the code was either validated or not. To validate a code, two consecutive ungarbled replies of the same mode (3A or C) must match. As shown by the data, the AN/TPX-42 declares the correct code with validation level in all cases above 99 percent. There is no significant variation in the data through 400 DABS fruit per second.

Further tests were conducted to determine if the addition of DABS fruit into an ATCRBS environment with lower reply probabilities degraded the system performance. Figure 23 contains the percent detection data for reply probabilities 1.0, 0.90, 0.80, and 0.70 for 0 and 200 DABS fruit per second. As indicated by the data, the addition of DABS fruit at any reply probability does not affect percent detection. As expected, reducing reply probability does reduce percent detection. Split data are shown in figure 24. A similar occurrence can be observed due to the reduction in reply probability. Splits



81-27-19

FIGURE 19. ARTS II PERCENT DETECTION

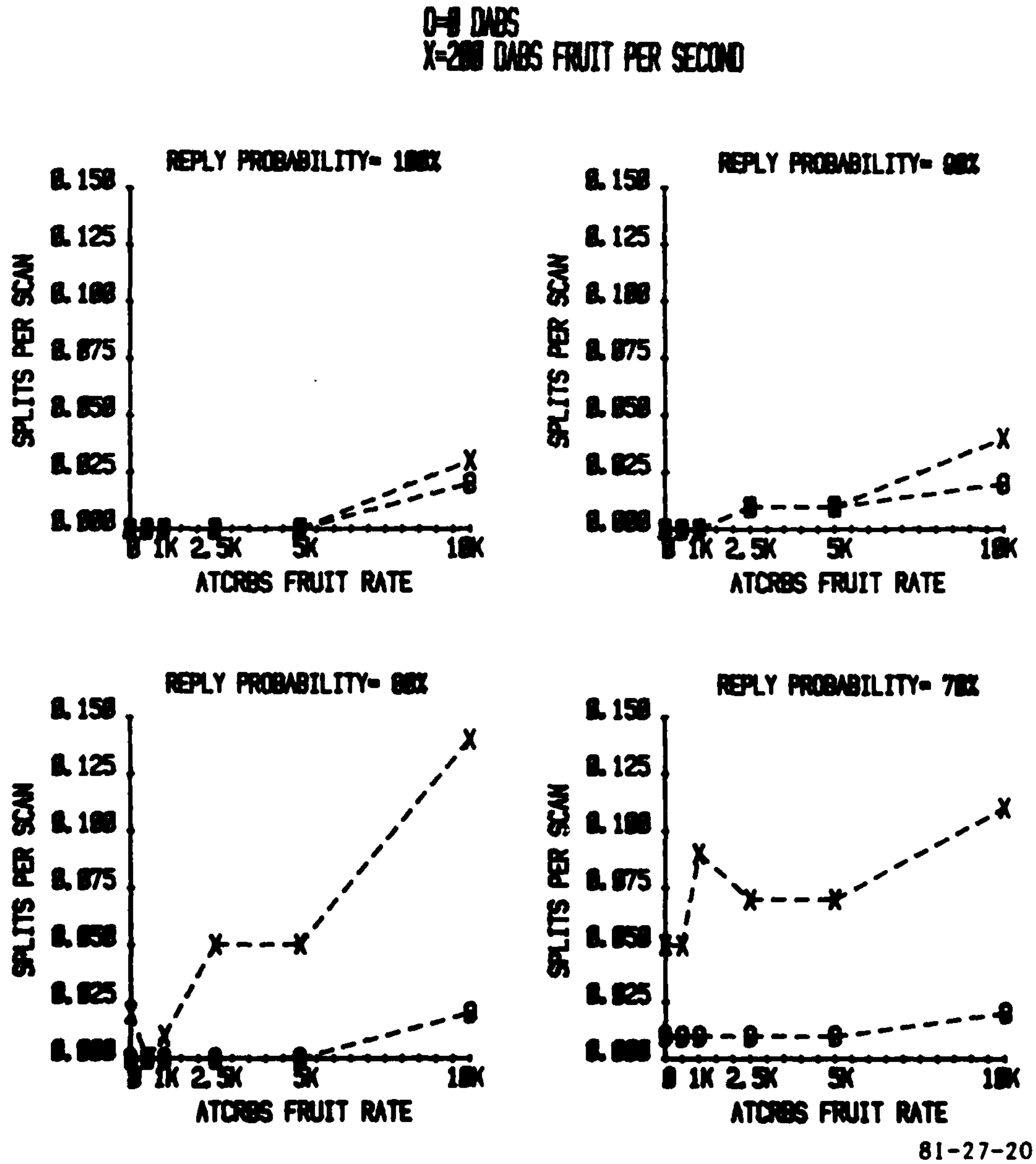


FIGURE 20. ARTS II SPLITS

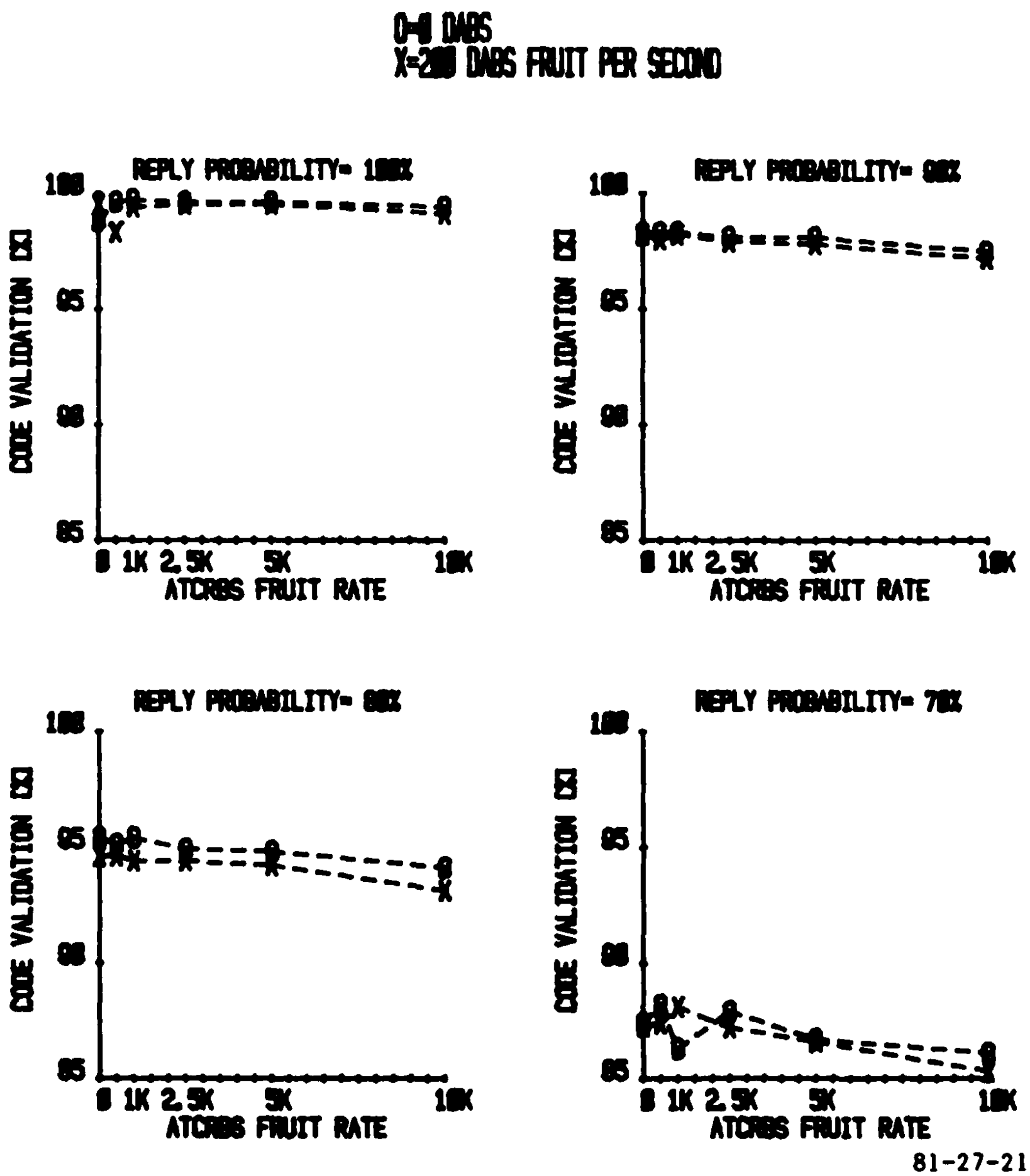
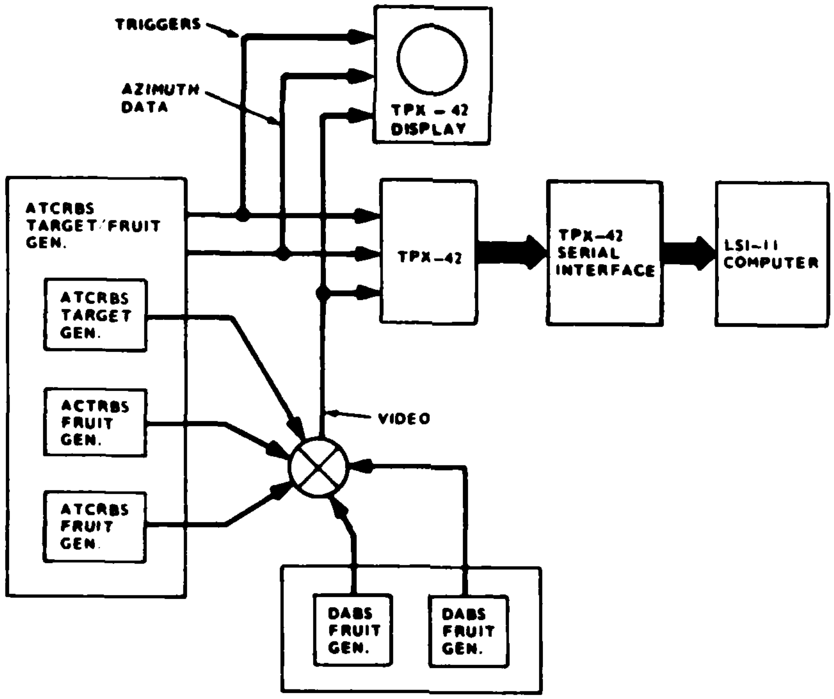


FIGURE 21. ARTS II CODE VALIDATION WITH CORRECT CODE



81-27-13

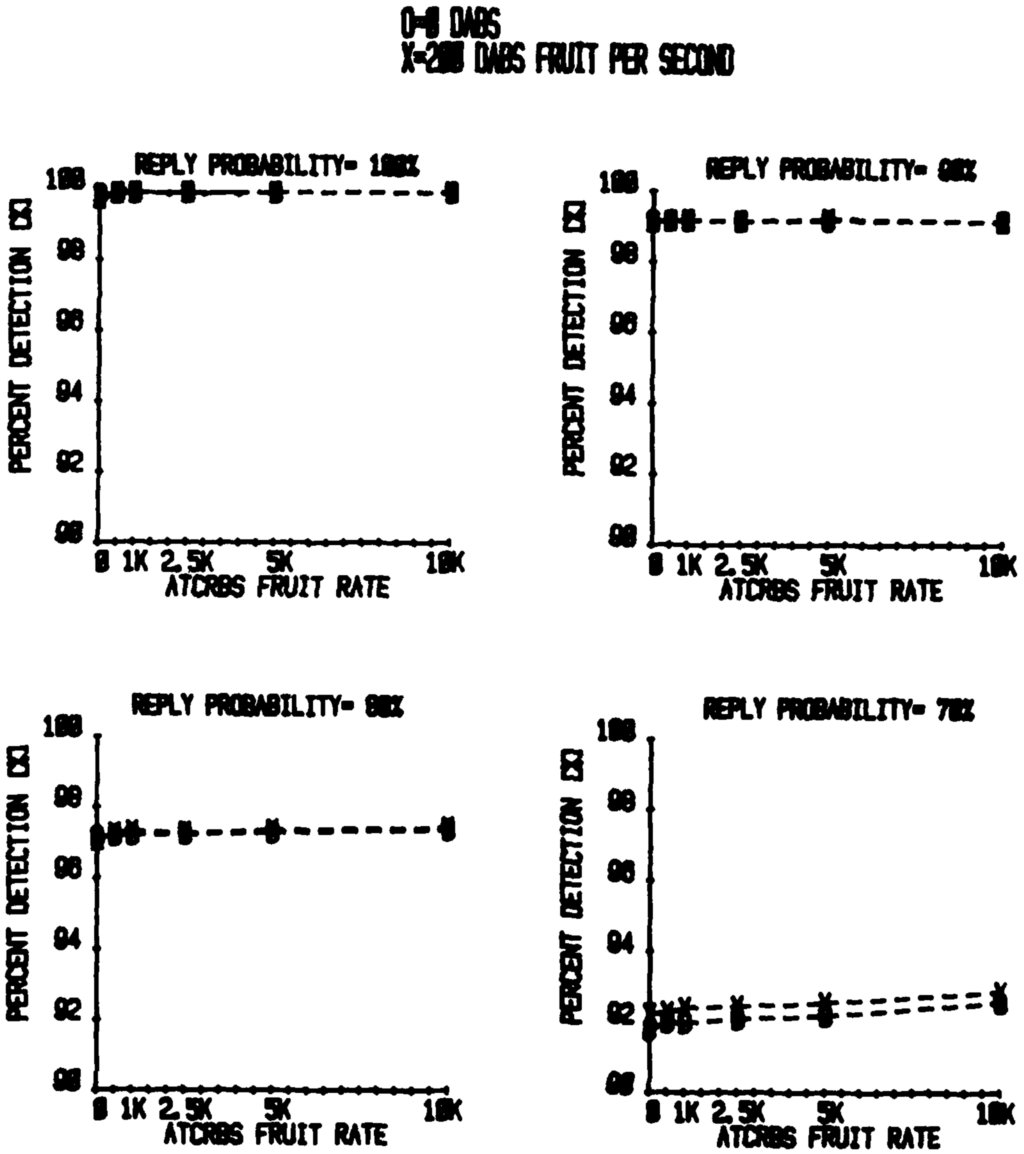
FIGURE 22. AN/TPX-42 TEST CONFIGURATION

increase as reply probability is decreased. There is no measureable increase in splits due to the addition of DABS fruit at any reply probability. Code validation in figure 25 gives the percentage of detected validated correct codes. The percentage of good codes with validation level one with the addition of DABS fruit is not decreased by more than 0.3 percent. The percentage of validation level one targets with correct codes is down below 99 percent for reply probability of 0.70.

COMMON DIGITIZER.

The test configuration for the DABS/ATCRBS compatibility tests is shown in figure 26. The standard data set was used for testing. Separate runs at a DABS fruit rate of 200 fruit per second were made while varying the desired target reply probabilities from 0.70 to 1.00. The standard performance criteria (percent detection, splits, false alarms, and code validation) were measured.

Early in the tests it became apparent that the standard setup for targets in range could not be used. The standard setup consisted of synchronizing the replies of two rings of test targets in range based upon a selected number of ATCRBS/target/fruit generator clocks after the occurrence of the pretrigger. However, at times, the split rate on one complete ring of targets would increase by several orders of magnitude without a known reason. Investigation showed that the common digitizer was producing range splits because the ring of targets was near the boundary of its range cells. The problem appeared and disappeared as a function of temperature when the cabinet doors were open or closed. It was decided to use a range counter



81-27-23

FIGURE 23. AN/TPX-42 PERCENT DETECTION

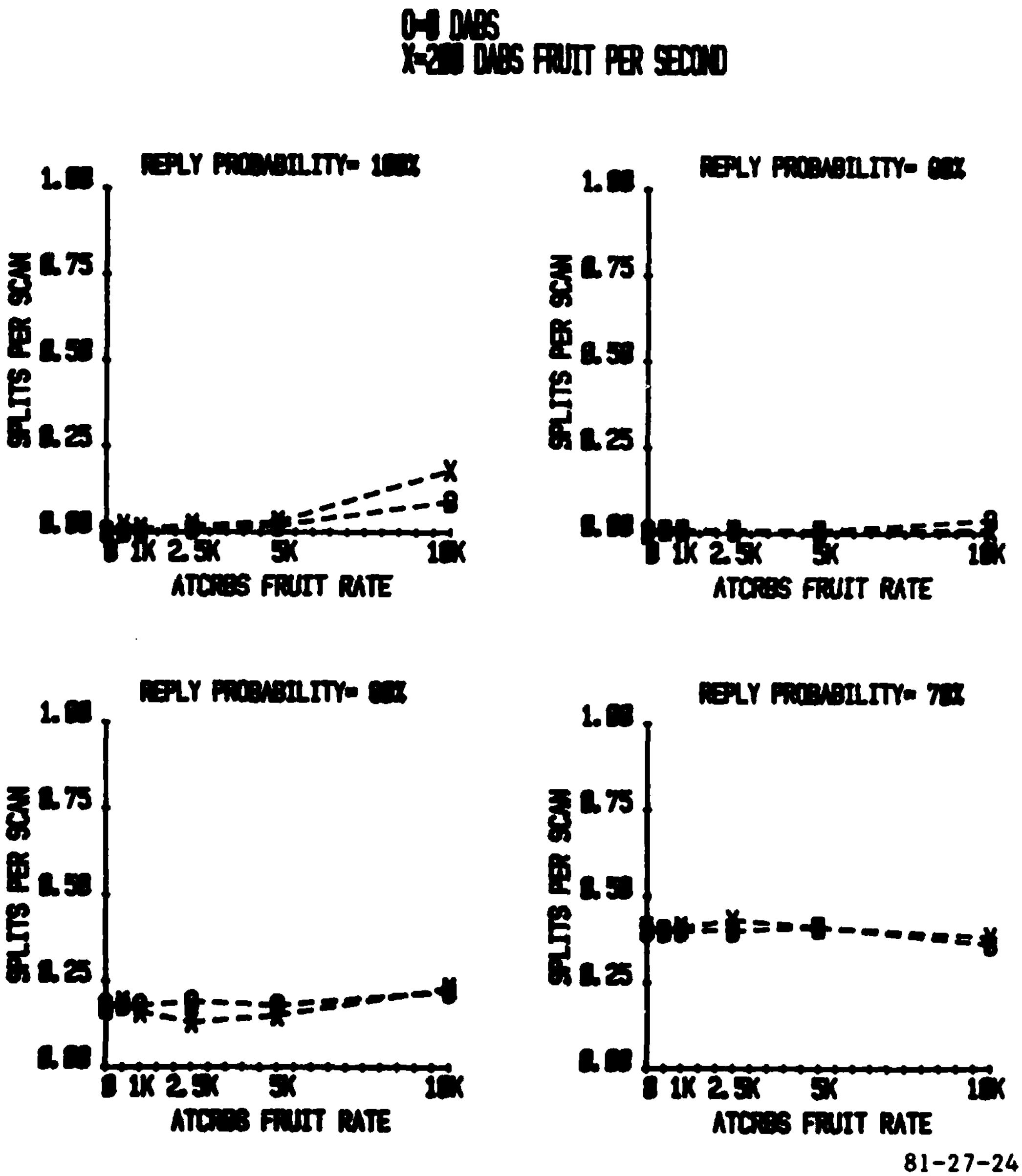
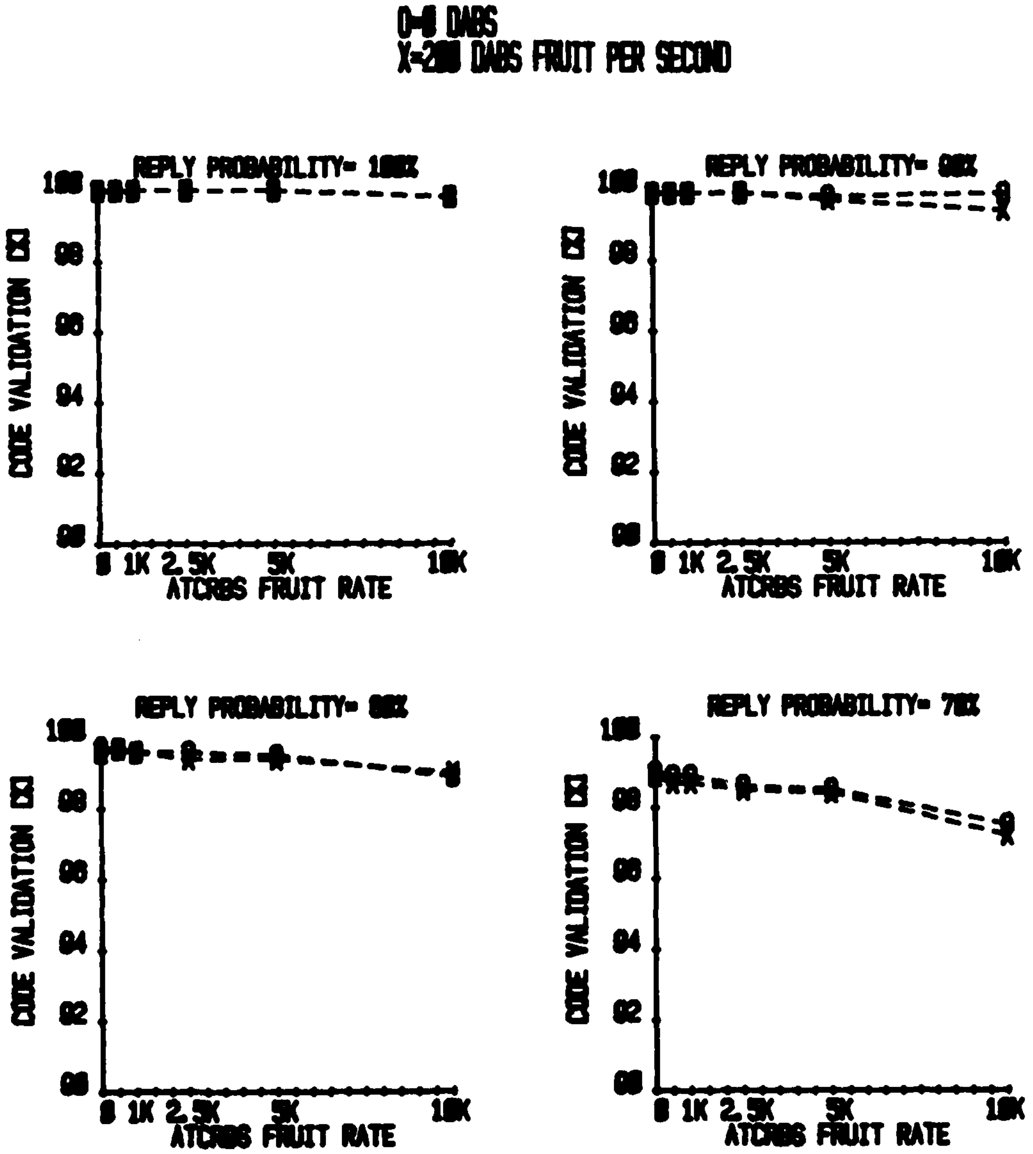


FIGURE 24. AN/TPX-42 SPLITS



81-27-25

FIGURE 25. AN/TPX-42 CODE VALIDATION WITH CORRECT CODE

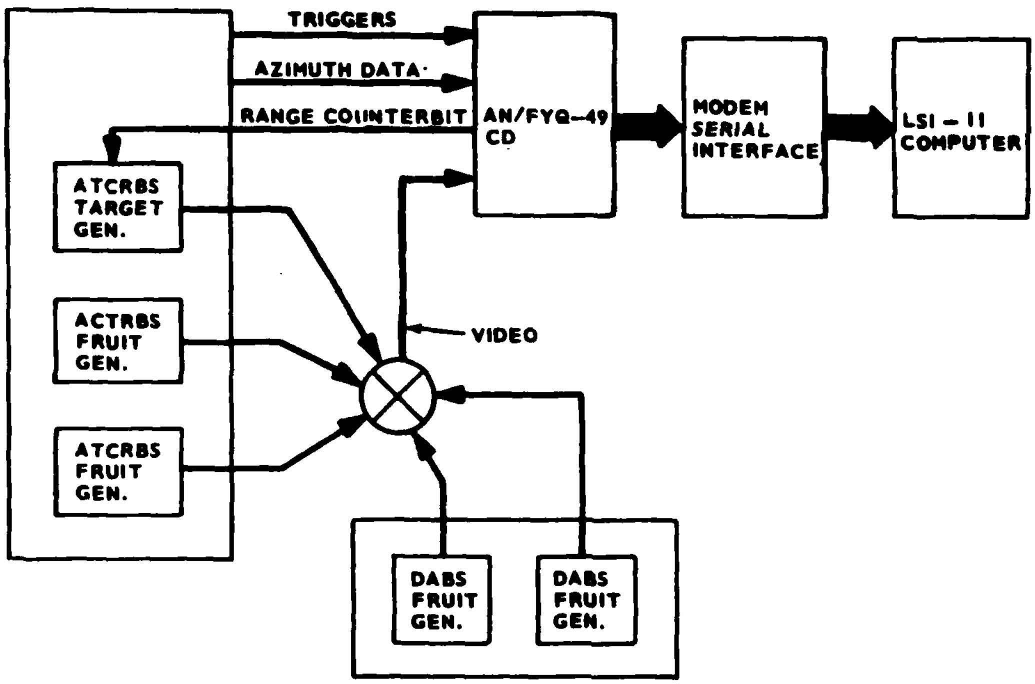


FIGURE 26. COMMON DIGITIZER TEST CONFIGURATION

bit to drive the range circuitry of the test target generator in order to assess the splits caused by DABS alone, independent of the range boundary of the common digitizer.

All data were collected with system parameters acknowledged as "standard" by Airways Facilities personnel: target lead edge (TL) = 6, target trail edge (TT) = 2, and target validation (TV) = 3.

The results of the common digitizer compatibility tests are contained in tables A-55, A-56, and A-57 for percent detection, splits, and false alarms. The results verify that there is no measurable difference in percent detection or splits for any DABS fruit rate when compared to the baseline ATCRBS only results. False alarms are slightly higher as the DABS fruit rate is increased. The increase in false alarms is gradual as the DABS fruit rate is increased and is only measurable above 2,500 ATCRBS fruit per second. At 200 DABS and 10,000 ATCRBS fruit per second, the resultant 2.89 false alarms per scan represents a 1.78, or almost 2 false alarms per scan increase from the baseline 10,000 ATCRBS fruit per second result. At 100 DABS and 10,000 ATCRBS fruit per second, the increase in false alarms from the baseline result is approximately 0.5 false alarms per scan or 1 extra false alarm every two scans. This is a worst case situation since most en route systems will not experience a 10,000 ATCRBS fruit rate.

The code validation data are presented in tables A-58 and A-59 for correct and incorrect mode 3A code detections. The valdiation levels are zero or one, validated code or not validated code, and the results verify that the targets were declared with validation level one

with the correct code in all cases for over 99 percent of the time.

The code validation of data for mode C were included for the common digitizer in tables A-60 and A-61 since the interlace ratio was two mode 3/A sweeps to one mode C sweep. The number of mode C replies per target is significantly less than mode A at this interlace ratio. Results verify that DABS fruit does not degrade the mode C code validation. The baseline percentage of mode C correct code is less than the equivalent baseline mode 3A validation result because of the interlace ratio.

Data were collected to verify that the common digitizer operating in a lower reply probability environment would also be immune to the injected DABS fruit. Reply probabilities of 1.00, 0.90, 0.80, and 0.70 were compared in a DABS fruit environment of 200 fruit per second. The results are shown in figures 27 and 28 for percent detection and splits. The results verify that there is no measurable effect due to the addition of DABS fruit at any of the reply probabilities.

COMBINED UPLINK/DOWNLINK.

The combined uplink/downlink testing consisted of measuring the target reports and reply detection (RD) from a fixed ATCRBS transponder (parrot) with an operational ARTS/air traffic control beacon interrogator (ATCBI)-5 ATCRBS system under various conditions of real world operation. The transponder was located atop the tallest structure in the city of Pleasantville, N.J., and hard-wired to respond with an ATCRBS mode 3/A code of 1233 and a mode C altitude of 2,800 feet. The parrot was approximately 4 miles in range from the test site and used a standard gain horn antenna to provide consistent reliable response. The test site was the TFAST facility with an ATCBI-5 transmitter/receiver and an ARTS III IOP. The standard ARTS Extractor program was used for data collection to record the number of target reports, replies, range, azimuth, etc. The normal FAA Technical Center ATCRBS electromagnetic environment (1030 MHz) includes the TFAST (test site), En Route Facility for Automation and Surveillance Testing (EFAST) facility at Elwood, N.J., the standard commissioned airport surveillance radar (ASR)-4 facility, and the DABS test site. All of these facilities, except the commissioned ASR-4, are test facilities. In addition, an ATCRBS siting system was used in the test. The ASR-4 is a commissioned facility used by the FAA Eastern Region. Consequently, all data includes any effects from the ASR-4 operation. The TFAST facility was used to collect all data. Target hit count, run length, and target reports were examined under various conditions of transponder loading. First, baseline data with just the TFAST and ASR-4 were collected; then DABS interrogations were added with the DABS antenna spotlighting (stopped and pointing directly at) the transponder. This simulates or forces a worse case condition where the normally rotating DABS antenna beam and an ATCRBS beam overlays an ATCRBS target. This would only occur once every cycle of the differential frequency between the rotational speeds of the DABS and ATCRBS antennas and would last approximately 40 ms (one beam width) of the antenna scan. In addition, a DABS downlink fruit rate of 200 fruit per second was input to the downlink processor (BDAS) to examine the effects of DABS fruit on the transponder target reports and RD. Any changes in parrot response from the baseline is attributed to suppressions resulting from DABS interrogations and fruit. The test was repeated over several runs and several days to establish test validity and repeatability.

Two different DABS interrogation scenarios were used in the test. Both scenarios used the maximum interrogation rate with 40 DABS targets in the beam width and 10 targets interrogated each DABS period plus 100 ATCRBS

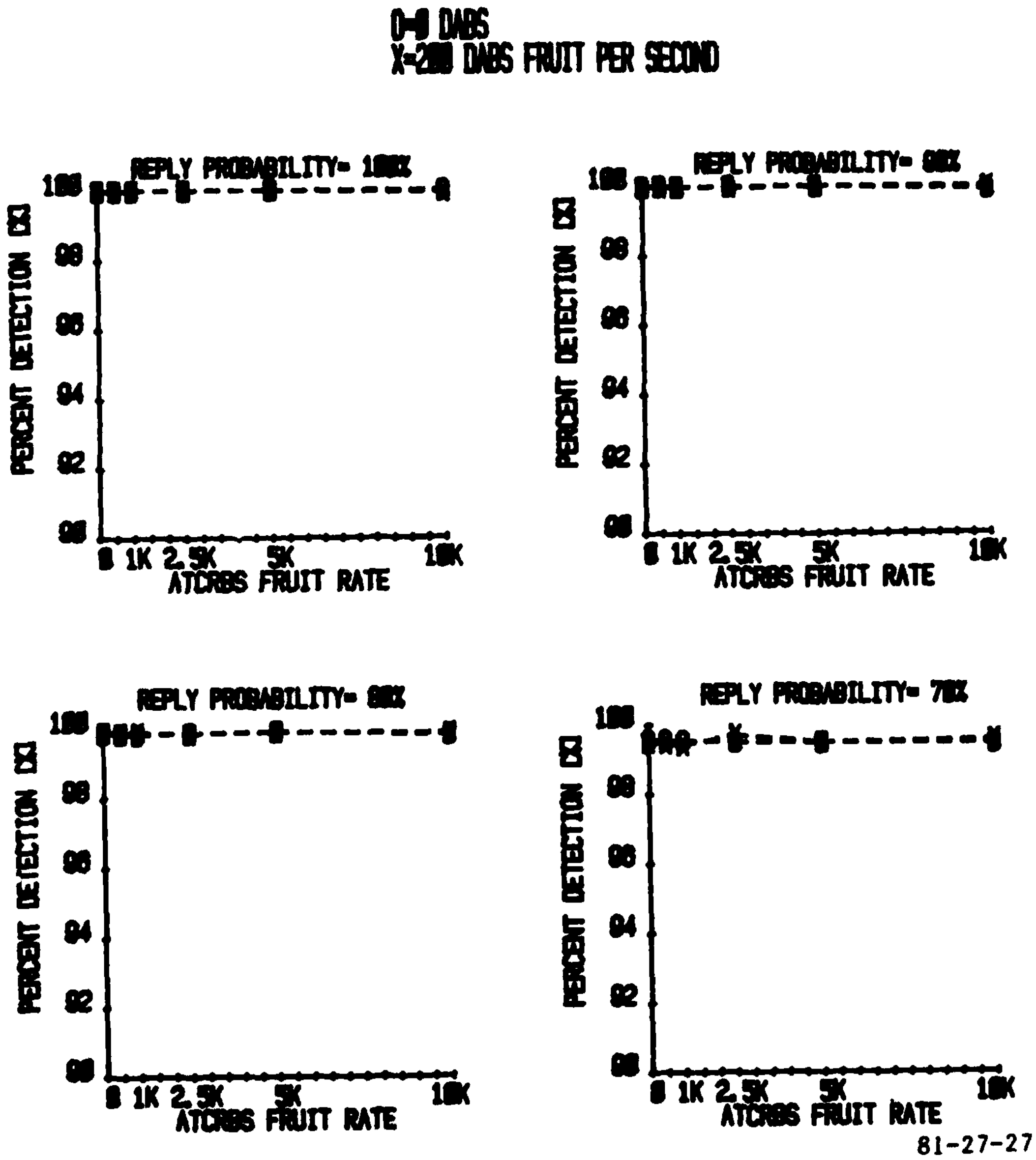
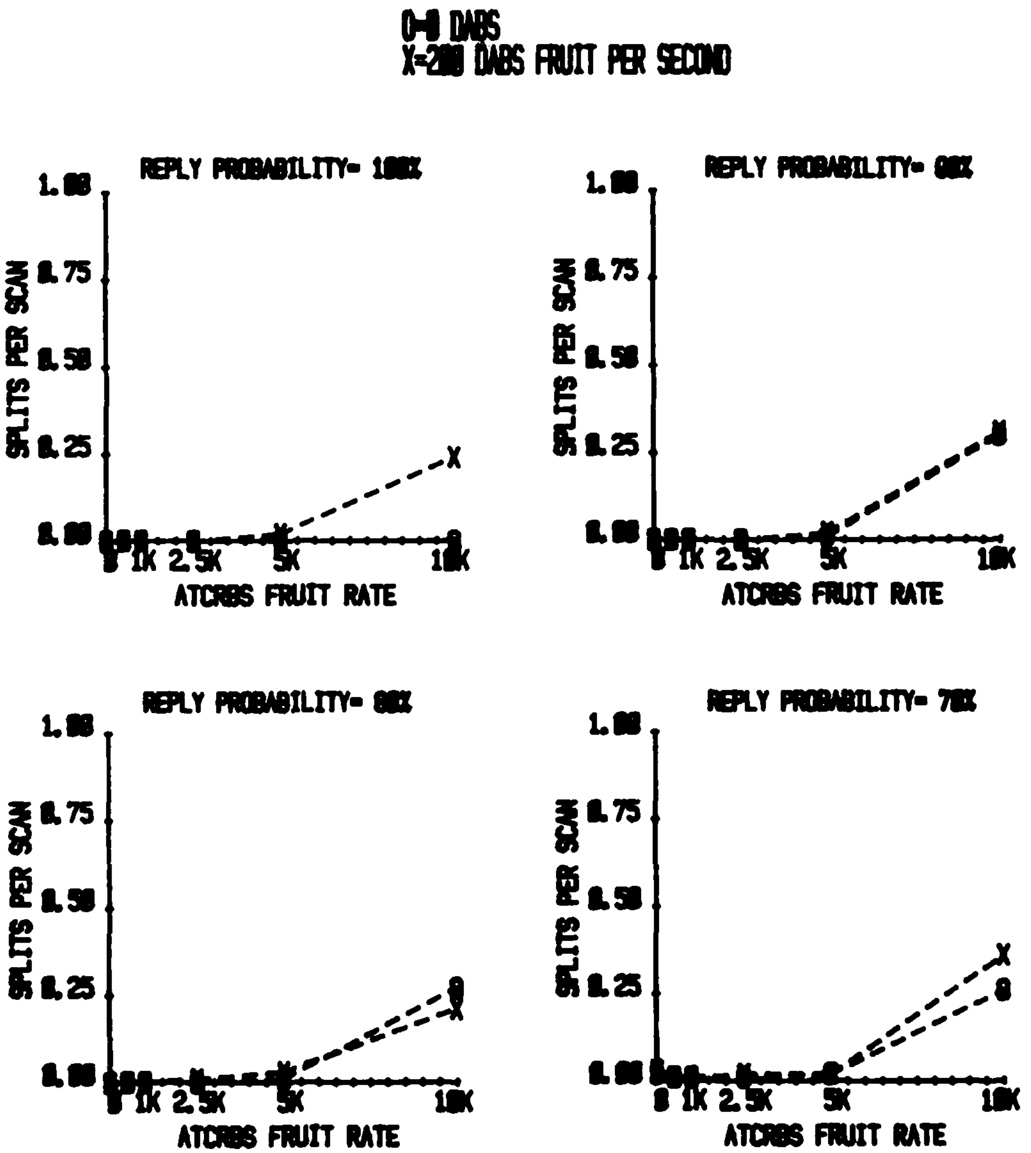


FIGURE . 7. COMMON DIGITIZER PERCENT DETECTION



81-27-28

FIGURE 28. COMMON DIGITIZER SPLITS

interrogations per second. The two scenarios differed only in range distribution of the 40 targets. Both scenarios exceeded the normal duty cycle capacity of the DABS transmitter equipment and required modification to override system alarms, etc.

As a second part of the test, the parrot was spotlighted with just the siting system (no DABS) and data were again collected at the TFAST. System parameters are given in table 4.

DATA COLLECTION. Data were collected at the TFAST with the ARTS Extractor Program on five different dates over a period of 2 months. The first two runs were approximately 20 and 30 minutes in duration. This was changed to 15-minute segments to reduce data loss due to equipment failures. Data were recorded for approximately 180 antenna scans per segment, then examined for 175 scans of each segment. The data were then analyzed and printed out in the form of tables 5 and 6. This printout provides the hit count distribution, total target reports, RD, run length, and miss distributions. Column 1 is hit count arranged in numerical order from 0 to 31. Column 2 is the number of antenna scans containing the number of hits (replies) in the corresponding line. For example, reading down column 2 in table 5, the first number other than 0 is 12. Reading left, the hit count reads 22. This means 12 scans of the total number examined contained 22 hits or replies. Reading right to column 3, this represents 6.86 percent of the 175 total scans examined. Continuing to the next column (No. 4), run length is 0 which indicates the run length is greater than 22; i.e., one or two misses in the scan. The next line (hit count of 23) shows 79 scans with 23 hits (45.14 percent), 38 scans had a run length of 23 with a reply detection of 98.86, 73.68 percent of the 38 scans had no misses, and 26.32 percent had one miss (hole). The next line indicates 1.46 percent of 137 scans had two misses and a hit count

TABLE 4. COMBINED UPLINK/DOWNLINK SYSTEM PARAMETERS

	ASR-4 (Commissioned)	TFAST	Siting System
Transmitter Power Out	130 W	110 W	100 W 275 W
Power Into Antenna	60 W	89-90 W	85 W
PRF	380	343	355
Interlace	1:1	1:1	2:1
Antenna RPM	15	12.75	12.75
STC		39 dB	
Antenna Type	Std. 5-ft Array	Hazeltine 4 ft (gain 23 dB)	7202 Hog Trough

TABLE 5. BASELINE DATA COLLECTION

Hit Count	No. of Scans	Percent	Run Length	Percent	RD	Miss Distribution 0 Misses	1 Miss	2 Misses	3 Misses	4 Misses
0	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
1	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
2	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
3	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
4	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
5	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
6	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
7	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
8	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
9	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
10	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
11	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
12	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
13	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
14	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
15	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
16	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
17	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
18	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
19	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
20	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
21	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
22	12	6.86	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
23	79	45.14	38	21.71	0.9886	73.68	26.32	0.00	0.00	0.00
24	84	48.00	137	78.29	0.9833	61.31	37.23	1.46	0.00	0.00
25	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
26	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
27	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
28	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
29	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
30	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
31	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00

Validity	VA	Percent	VC	Percent
0	0	0.00	0	0.00
1	0	0.00	0	0.00
2	0	0.00	0	0.00
3	175	100.00	175	100.00

June 30, 1980
Baseline
First 15 min.
No DABS
No Siting System

Total Targets = 175
Reply Detection = 98.44 percent

TABLE 6. DATA COLLECTION WITH DABS

Hit Count	No. of Scans	Percent	Run Length	Percent	RD	Miss Distribution 0 Misses	1 Miss	2 Misses	3 Misses	4 Misses
0	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
1	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
2	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
3	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
4	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
5	1	0.56	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
6	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
7	0	0.00	1	0.56	0.7143	0.00	0.00	100.00	0.00	0.00
8	1	0.56	1	0.56	1.0000	100.00	0.00	0.00	0.00	0.00
9	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
10	1	0.56	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
11	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
12	0	0.00	1	0.56	0.8333	0.00	0.00	100.00	0.00	0.00
13	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
14	1	0.56	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
15	3	1.69	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
16	4	2.26	1	0.56	0.8750	0.00	0.00	100.00	0.00	0.00
17	11	6.21	1	0.56	0.8824	0.00	0.00	100.00	0.00	0.00
18	17	9.60	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
19	41	23.16	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
20	29	16.38	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
21	33	18.64	2	1.13	0.8810	0.00	0.00	50.00	50.00	0.00
22	23	12.99	23	12.99	0.8379	0.00	8.70	8.70	39.13	17.39
23	7	3.95	56	31.64	0.8533	3.57	12.50	21.43	16.07	21.43
24	5	2.82	89	50.28	0.8539	5.62	5.62	16.85	21.35	19.10
25	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
26	0	0.00	1	0.56	0.7692	0.00	0.00	0.00	0.00	0.00
27	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
28	0	0.00	1	0.56	0.7857	0.00	0.00	0.00	0.00	0.00
29	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
30	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
31	0	0.00	0	0.00	0.0000	0.00	0.00	0.00	0.00	0.00

Validity	VA	Percent	VC	Percent
0	0	0.00	1	0.56
1	0	0.00	0	0.00
2	0	0.00	0	0.00
3	177	100.00	176	99.44

July 10, 1980
W/DABS Scenario
W/200 DABS Fruit

Total Targets = 177
Reply Detection = 85.12 percent

of 24. Table 5 shows a baseline, no DABS, and a reply detection of 98.44. Table 6 is a sample run with DABS scenario 1 and 200 DABS fruit. The reply detection was 85.12 with two splits since 175 scans were examined and 177 targets reported.

DISCUSSION. A data summary for all runs is given in table 7. Runs 1, 4, 6, 8, 9, 10, 20, 21, and 28 are all baseline test runs for each test date. The RD for these runs varied from 98.05 up to 98.57 percent; a variation of only 0.52 percent. The RD average was 98.29 percent. This indicates excellent repeatability for the duration of the test. The impact of DABS spotlighting with scenario No. 1 is a decrease in RD of 10 percent to an average of 88.27 percent. DABS scenario No. 2 resulted in a decrease in RD of 11 percent to an average of 87.06 percent. This reduction is attributed to DABS suppressions and the ATCRBS interrogations (100 per second) from the DABS sensor; i.e., uplink 1030 MHz) interference to the transponder. The injection of 200 DABS fruit (twice the expected maximum rate) further reduced the RD with scenario No. 2 to 85.69 percent, an additional reduction of 1.37 percent. Likewise, the 200 DABS fruit reduced the RD with scenario No. 1 an additional 1.65 to 86.62 percent. These reductions (1.37 and 1.65 percent) are downlink (1090 MHz) interference and are really the result of garbling the transponder reply; i.e., the transponder most likely did reply but was masked out or garbled at the input to the downlink processor. Again, these reductions are with the DABS antenna spotlighting the parrot creating the worse case condition. Assuming the ATCRBS antenna rotating at 12 revolutions per minute (rpm) and the DABS at 15 rpm or vice versa, this would only happen for approximately 40 ms every 20 seconds. This does not include considerations of pulse repetition frequency (PRF) and other factors. Test runs 31, 32, 33, and 34 were with the DABS antenna rotating at approximately 12.6 rpm. This resulted in a reduction of RD by 1.11 to 97.18 percent. A reduction of approximately 0.98 percent was experienced with the ATCRBS siting system spotlighting the parrot. This was with a fixed PRF of 355 as compared with the DABS 100 ATCRBS interrogations combined with the 40 target DABS all-call/roll-call interrogations. Only one run (run No. 5) showed a hit count of 5 and a run length of 12 for 1 antenna scan out of 250 scans. All other runs showed no degradation of RD or declared target reports. The worse case splits were run No. 16 with DABS scenario No. 2 and 200 DABS fruit. Three splits occurred but with no loss of target. These splits would be corrected with software correlation and would cause no degradation in ARTS system performance.

DATA SUMMARY. In summary, the spotlighting of the ATCRBS transponder with the two DABS interrogation scenarios caused *a slight reduction in RD of 10 to* 11 percent as predicted. This caused a minor increase in splits reported by the ARTS III system at the TFAST facility but did not result in any loss of target reports. Overall, the total combined measured interference from DABS did not have any significant impact on the target tracking capabilities of the ARTS system.

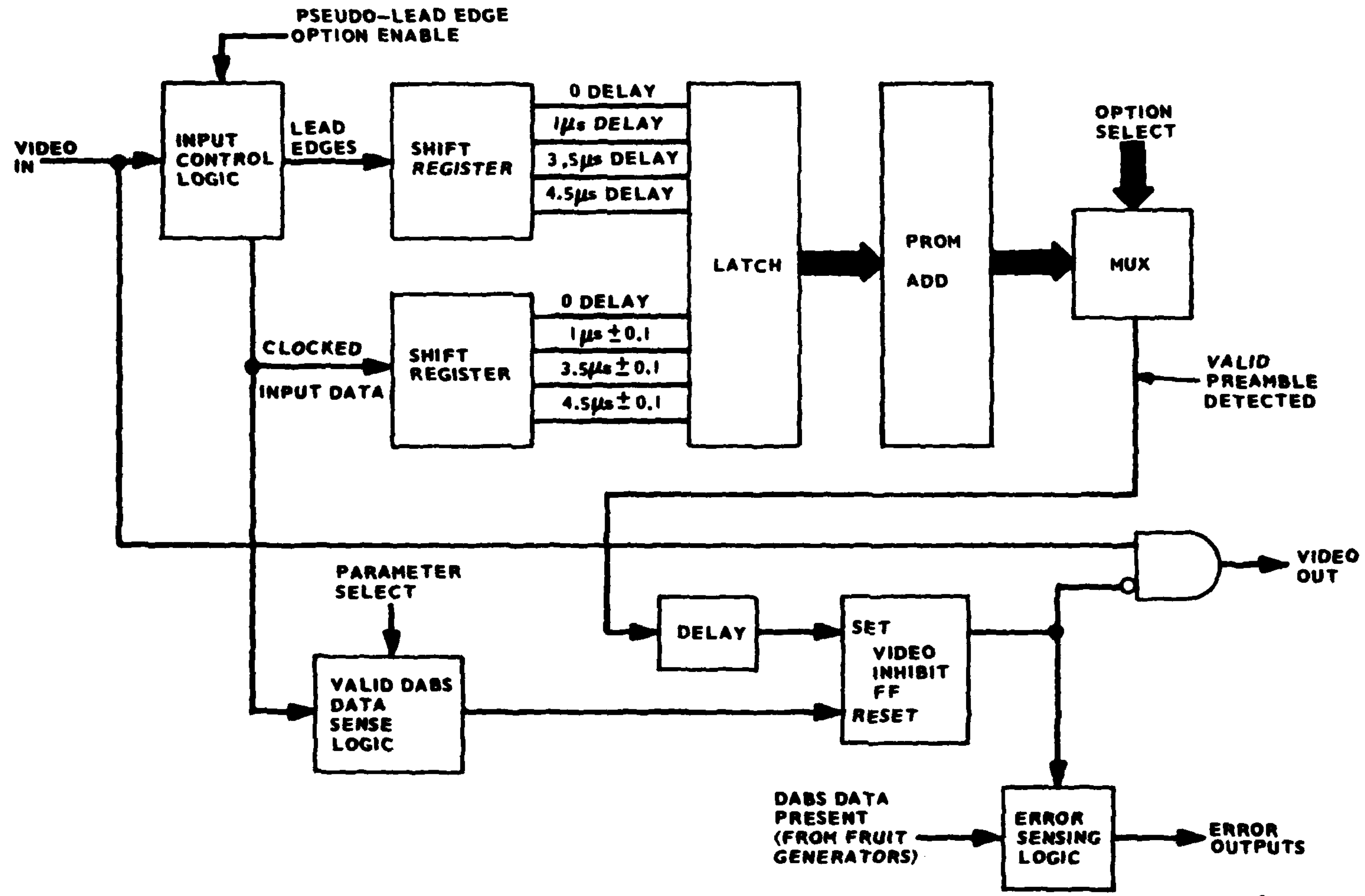
DABS PREAMBLE DETECTOR.

The DABS preamble detector was designed to eliminate DABS fruit from the input beacon video to an ATCRBS processor. The preamble detector receives the beacon video normally input to the ATCRBS processor. It passes the normal ATCRBS replies and eliminates the DABS replies by detection of the four DABS preamble pulses, inhibiting the data pulses of the DABS reply which begins 8 μs after the occurrence of the first preamble pulse. A block diagram of the preamble detector is shown in figure 29.

TABLE 7. COMBINED UPLINK/DOWNLINK DATA SUMMARY

Test No.	Condition	No. Scans	No. Target Reports	Reply Reception	Remarks
*1	Baseline	300	300	98.05	
2	With DABS scenario #1	265	265	93.30	DABS developed problem part way through test
3	With DABS scenario #1	196	196	87.61	Test terminated early due to higher priority test activities
*4	Baseline	250	250	98.36	1 target below hit count of 11, run length of 15
5	No DABS with siting system	250	250	96.87	1 target with hit count of 5 and run length of 12
*6	Baseline	250	250	98.13	Run length varied from 22 to 25
7	No DABS with siting system			97.91	
*8	Baseline	175	175	98.44	Runs reduced to 15-minute segments to reduce data loss
*9	Baseline	175	175	98.20	
*10	Baseline	175	175	98.39	
11	With DABS scenario #1	176	176	86.03	
12	With DABS scenario #1	175	175	90.43	1 scan with hit count below 11
13	With DABS scenario #2	175	176	86.96	1 split indicated
14	With DABS scenario #2	175	175	86.69	1 scan with hit count of 5
15	With DABS scenario #2, DABS fruit 200	175	176	85.31	1 split
16	With DABS, scenario #2, DABS fruit 200	175	178	85.28	3 splits indicated
17	With DABS, scenario #1, DABS fruit 200	175	177	88.46	2 splits indicated
18	With DABS scenario #1, fruit 200	175	175	85.75	
19	No DABS with siting system	175	175	97.14	
*20	Baseline	174	174	98.44	
*21	Baseline	172	172	98.11	A/C flew over parrot for 3 scans and garbled replies
22	With DABS scenario #1, no fruit	175	176	89.12	1 split
23	With DABS scenario #1, no fruit	160	161	88.17	1 split, test terminated early
24	With DABS scenario #1, DABS fruit 200	175	177	85.12	2 splits
25	With DABS scenario #1, DABS fruit 200	175	176	87.15	1 split
26	With DABS scenario #2, DABS fruit 200	175	176	85.61	1 split
27	With DABS scenario #2, DABS fruit 200	175	175	86.56	
*28	Baseline	175	175	98.57	
29	With DABS scenario #2	175	176	87.75	1 split
30	With DABS scenario #2	175	176	86.65	1 split
31	With DABS scenario #2, DABS ant. rotating	175	175	97.27	
32	With DABS scenario #2, DABS ant. rotating	175	175	97.08	
33	With DABS scenario #2, DABS ant. rotating	175	175	97.10	
34	With DABS scenario #2, DABS ant. rotating	175	175	97.36	

*Baseline



81-27-29

FIGURE 29. BLOCK DIAGRAM PREAMBLE DETECTOR

The DABS preamble detector was built with certain preamble detection criteria as flexible parameters to enable performance optimization. The performance of the preamble detector with various combinations of the selectable parameters was evaluated by measuring the amount of mistakes the preamble detector made in various DABS/ATCRBS fruit environments. The two types of mistakes possible are: (1) missing true DABS preambles which results in not blanking a true DABS reply, and (2) falsely blanking a non-DABS reply. The optimum settings of the parameters were based upon minimizing both errors.

A description of the selectable parameters and their values follow:

1. Lead edge only/P1 ± 1 clock.

a. Lead edge only. A valid lead edge is detected for each lead edge occurring in one of the four valid preamble pulse positions. The valid positions are ±100 nanoseconds of the nominal pulse positions of the last three pulses with respect to the nominal pulse position of the first pulse (P1). A valid lead edge for P1 is only at the nominal position.

b. P1 ± clock. The valid lead edge pulse positions are ±100 nanoseconds of the nominal pulse positions for all four pulses.

2. Number of valid lead edges to declare preamble.

a. Four of four. A valid lead edge must be detected in all four pulse positions.

b. Three of four. A valid lead edge must be detected in any three of the four pulse positions, but a pulse must be present in the remaining position.

c. Two of four. A valid lead edge must be detected in any two of the four pulse positions, but a pulse must be present in the remaining two.

3. Pseudo-lead edge (PLE) on/off. A pseudo-lead edge will be inserted five clocks prior to the trail edge of a pulse, which is wider than 600 nanoseconds. This option helps detect the preamble when distorted because of overlapping DABS or ATCRBS pulses.

4. Number of consecutive misses before terminating the block selectable from 1 to 16.

5. True DABS/energy only. This option allows the selection of requirements to be met before reloading the consecutive miss counter to the selected value. The true DABS option requires a true DABS data format (a 1/0 or a 0/1 every μs), while the energy only option merely requires a pulse to be present.

These options and their selections determined the performance of the preamble detector. Two errors were monitored to optimize its performance. Error 1 measures how many times DABS data were not blanked, and how many times blanking did not occur until later in the message. Data not being blanked are a result of a DABS preamble not being detected. Error 2 indicates that the blanker turned off before the end of the data. This is either a result of the miss criteria or a false preamble being detected.

Data were initially collected to determine the efficiency of the preamble detector in an ATCRBS only environment. The lead edge/P ±1 clock option, the number of lead edges (2/4, 3/4, 4/4) option, and pseudo-lead edge option were varied to determine optimum.

Error 2, the number of false preambles detected, was monitored since there should be no preambles found in an all ATCRBS environment. The ATCRBS video reply rate was 5,000 (data are shown in figures 30 and 31). Data were collected

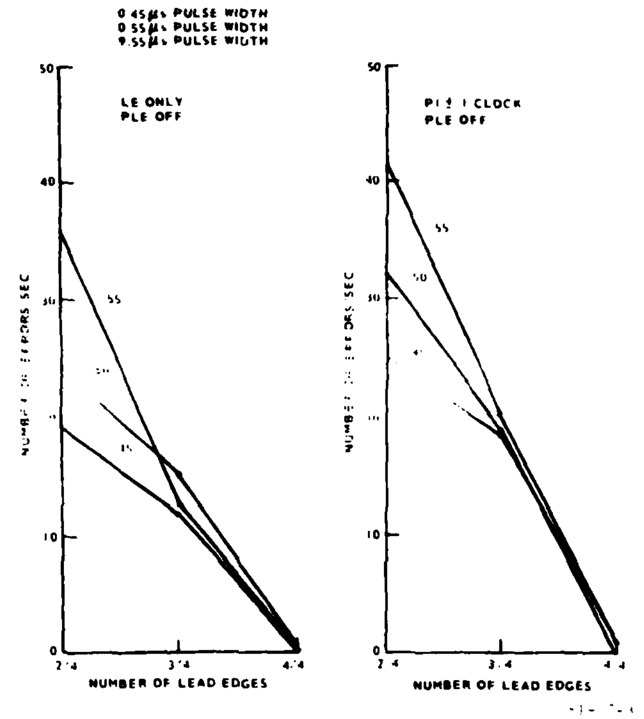


FIGURE 30. ATCRBS REPLIES FALSELY ELIMINATED BY PREAMBLE DETECTOR, PLE OFF

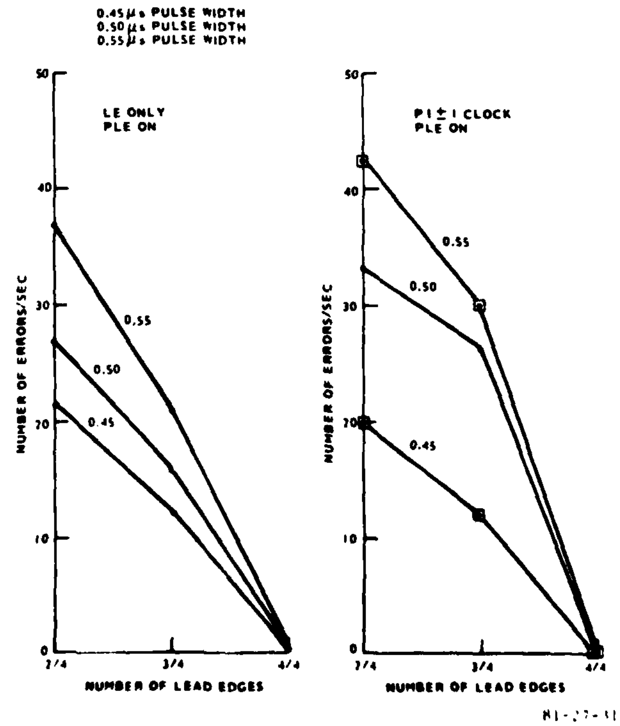


FIGURE 31. ATCRBS REPLIES FALSELY ELIMINATED BY PREAMBLE DETECTOR, PLE ON

with the ATCRBS reply video at three pulse widths, nominal 0.45, 0.50, and 0.55 μs. The results indicate that for all three pulse widths, 4/4 lead edges created the least amount of false preambles. Pseudo-lead edge did not significantly change the number of errors. P1 ±1 clock option increased errors very slightly.

The preamble detector was evaluated in a DABS only environment to evaluate error 1, the number of valid missed preambles. The number of errors for the different configurations as a function of DABS fruit is shown in figure 32. As indicated, and as expected, 2/4 lead edge for all configurations shown causes the least number of errors. The number of errors per second at 4/4 for all configurations is less than 4.5 per second at the highest DABS fruit rate of 2,000 fruit per second. The difference between error rates of 2/4 and 4/4 is minimal. Pseudo-lead edge option "on" decreased the number of errors very slightly. The lead edge only or P1 ±1 clock option had no significant difference in the number of errors.

The criteria for determining the end of the DABS message to inhibit blanking was evaluated. The energy only/true DABS option and the number of misses in a row to halt blanking were the variables tested. The performance at the various settings of these parameters was evaluated by error 2 in a DABS only environment. Error 2 in a DABS only environment indicates the number of occurrences of the blanker turning off before the end of a DABS message.

Figure 33 compares the number of errors between true DABS at eight misses and energy only at two misses. The number of errors of energy only at two misses is significantly less than true DABS at eight misses. Obviously, it is advantageous to minimize the number of misses to stop inhibiting as soon as possible after the end of a DABS message.

It was found by further data collection that the parameters determining the shutoff of the blanker criteria also affected error 1 (data not blanked). The reason was found to be overlapped DABS replies. When DABS replies are overlapped and the preamble detector is blanking by correctly detecting the first reply's preamble, the criteria for turning the blanker off determines whether the blanker will remain on through the duration of the second reply. There is at least a 3 μs blank period between the last preamble pulse and the beginning of the DABS data block. Therefore, if no other pulse energy exists in this time frame (for the energy only criteria), the miss criteria below three for true DABS or energy only options will turn off the blanker, thus missing the remainder of the second reply and causing error 1. Figure 34 verifies this deficiency, especially at the high fruit rates where there are frequent overlap situations. Figure 35 shows error 1 comparisons for different miss values for both the true DABS option and energy only option.

In general, energy only above three minimizes these errors due to overlap. True DABS at three has a high error rate, but the error rate at true DABS at four and five are only slightly higher than the equivalent energy only miss value. True DABS at six misses matches energy only at six.

Different configurations of the preamble were run with a combination of DABS and ATCRBS to evaluate the preamble performance. Comparisons of error 1 and 2 were done for 4/4, 3/4, and the true DABS, energy only, and number of misses parameters. The results are compiled in table 8. The environment compared at the standard 64 ATCRBS targets, DABS fruit at the various values indicated and ATCRBS fruit at the various values shown. As shown by the data, error 1 (missed or late blanks) is minimized with the 4/4 lead edge option, except in

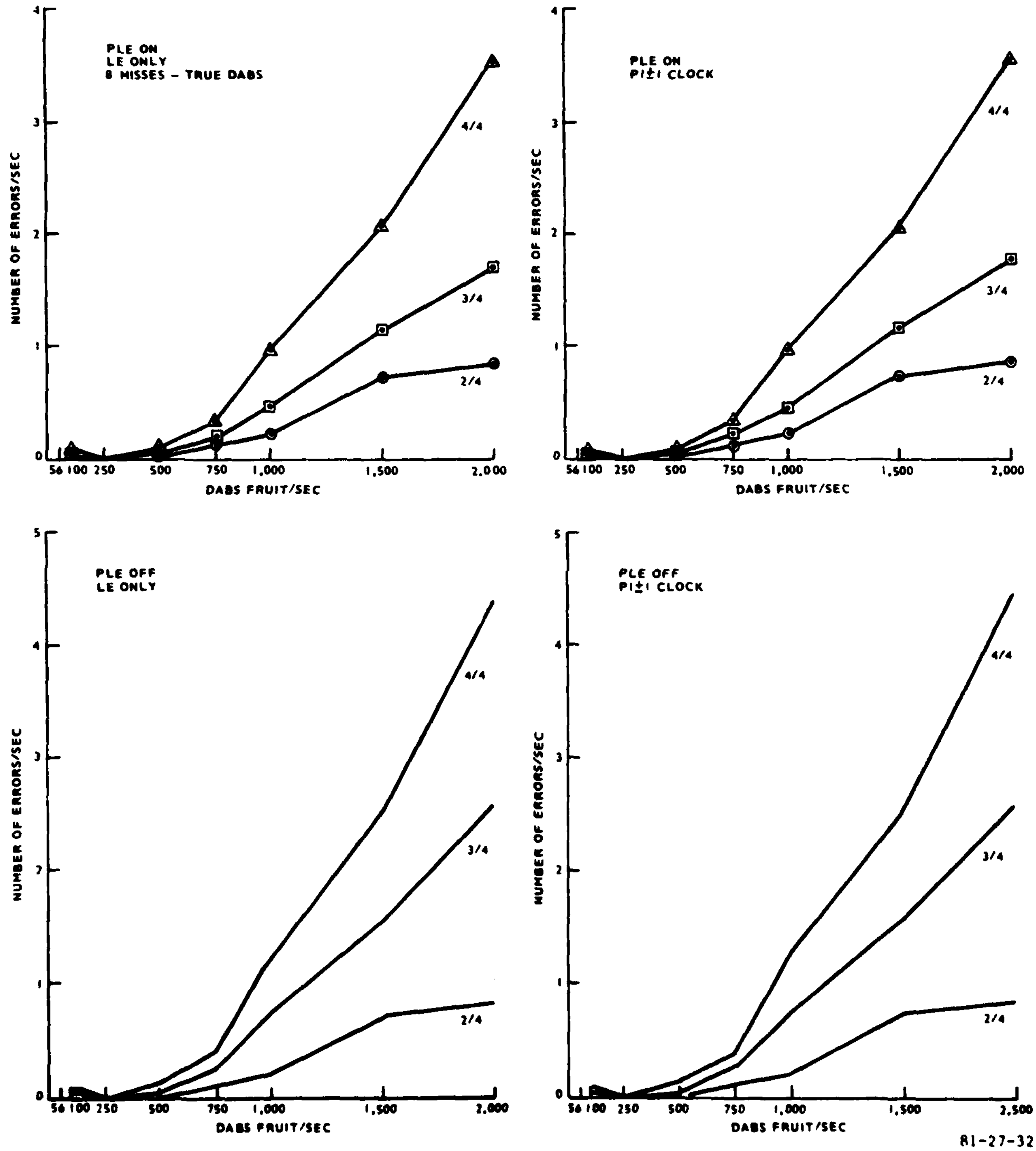


FIGURE 32. DABS PREAMBLE DETECTOR ERRORS (PREAMBLES NOT DETECTED)

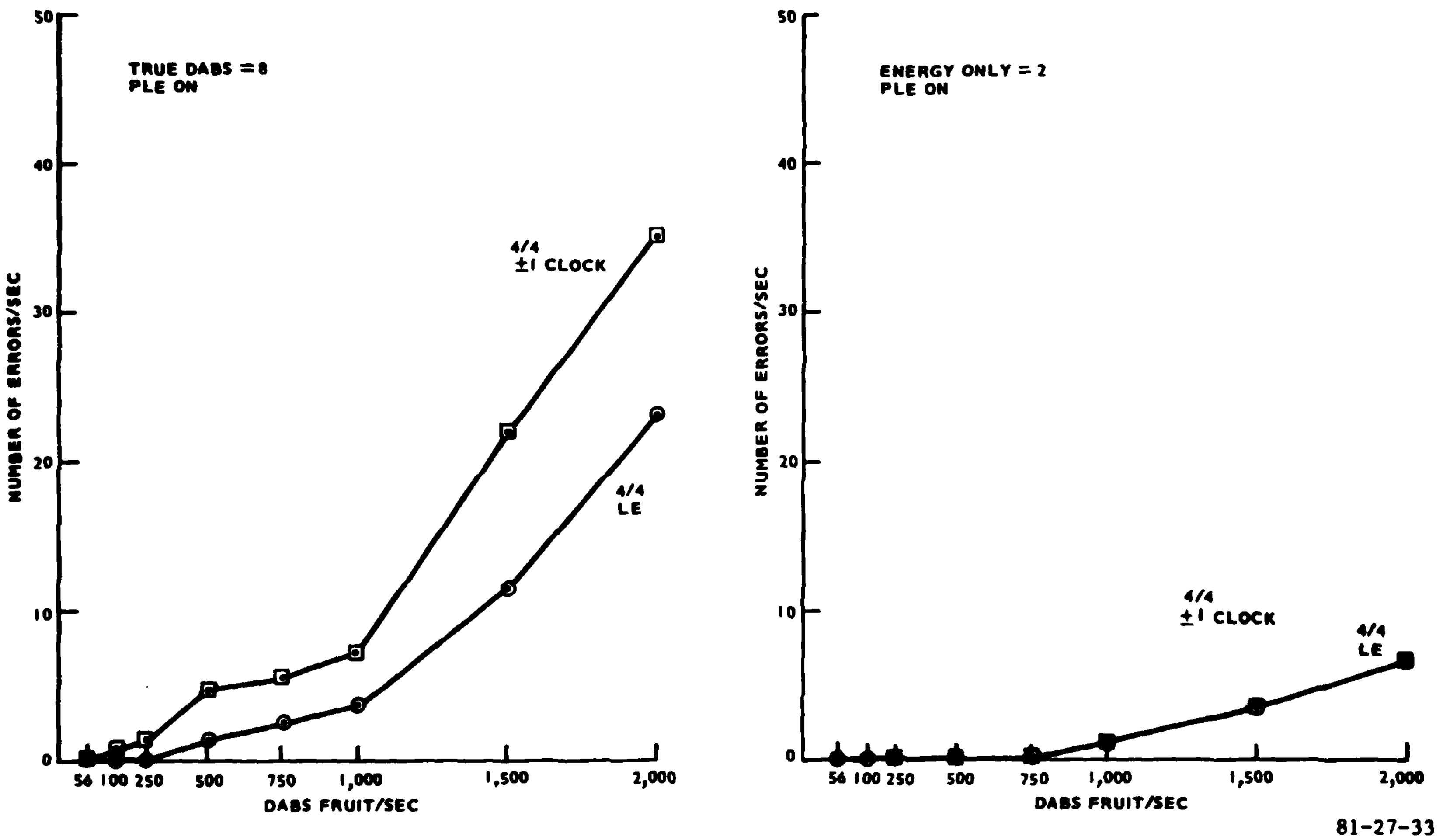


FIGURE 33. DABS PREAMBLE DETECTOR ERRORS (TURNING OFF BEFORE END OF REPLY)

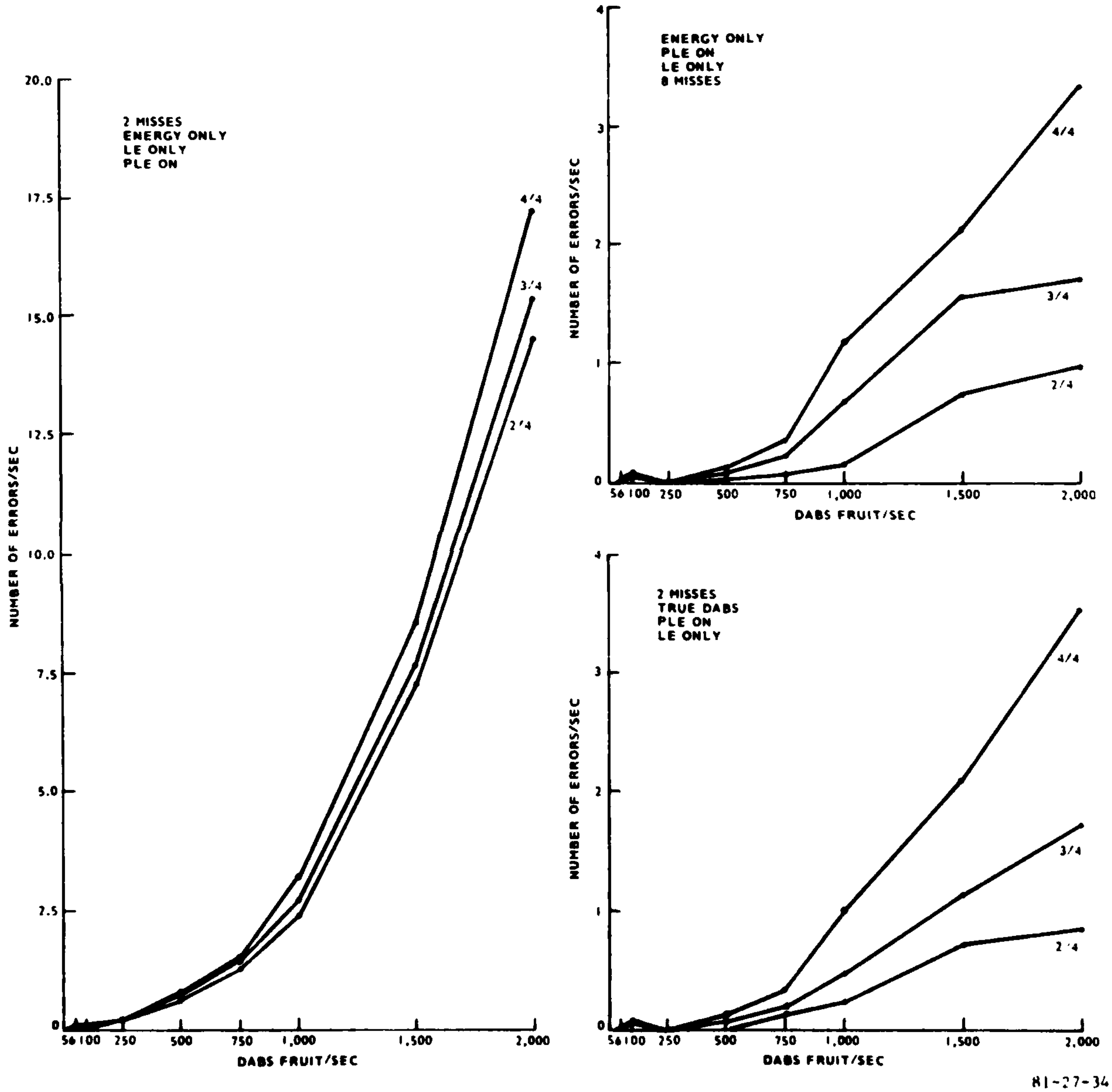


FIGURE 34. DABS PREAMBLE DETECTOR ERRORS (DATA NOT BLANKED), MISSING OR LATE

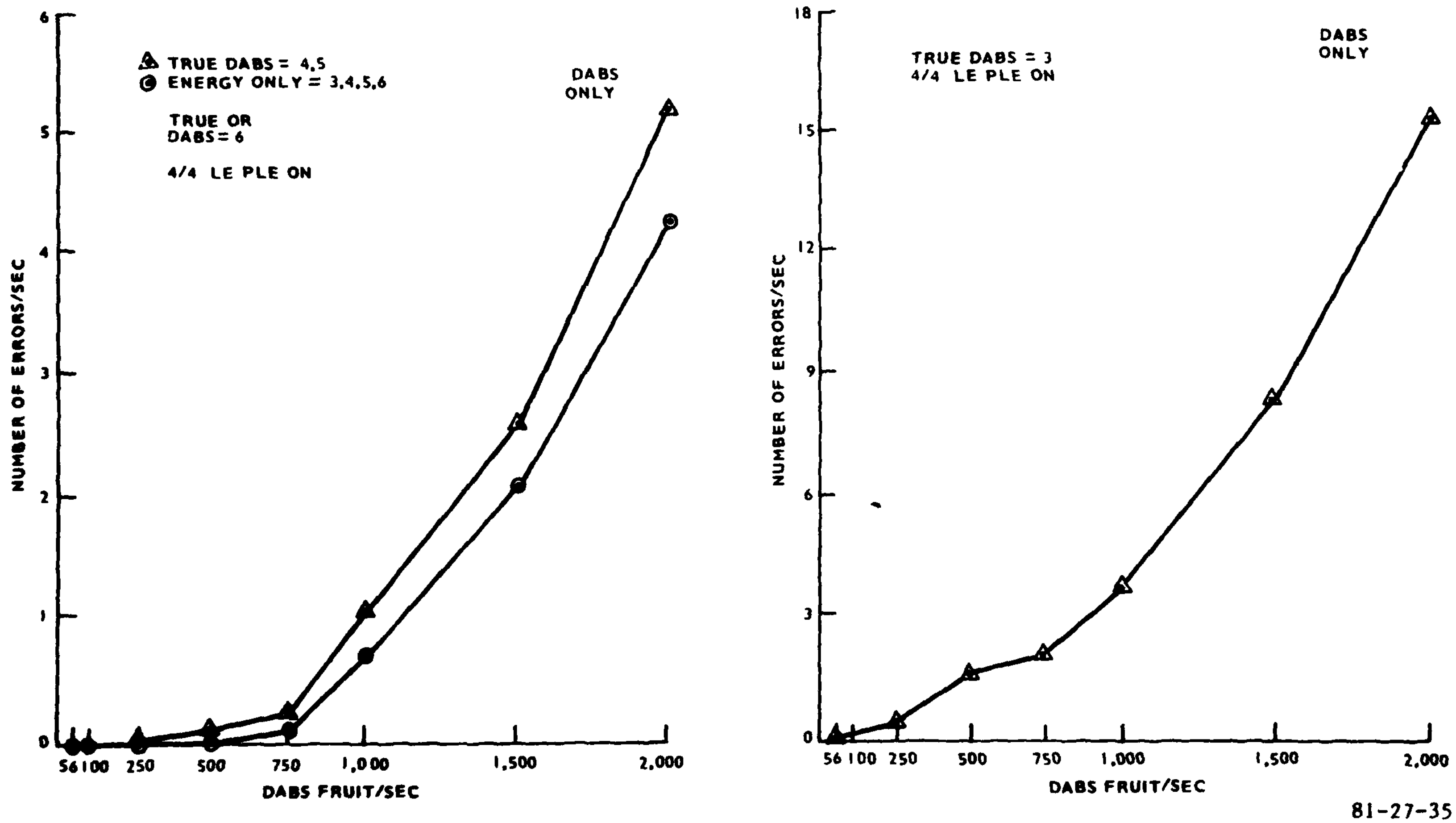


FIGURE 35. DABS PREAMBLE DETECTOR (BLANKER MISSING OR LATE)

TABLE 8. DABS PREAMBLE DETECTOR (DABS/ATCRBS ENVIRONMENT PERFORMANCE)

	0 DABS				56 DABS				250 DABS				
	3/4		4/4		3/4		4/4		3/4		4/4		
	Error 1	Error 2	Error 1	Error 2	Error 1	Error 2	Error 1	Error 2	Error 1	Error 2	Error 1	Error 2	ATCRBS Fruit/Sec
Energy only 2 misses	0		0	0	0	0	0	1	54	1	125	0	0
	0		0	1	0	321	0	1	54	5	124	7	500
	0		0	2	1	671	0	4	63	9	134	6	1,000
	0		0	16	0	2,026	2	14	71	33	146	23	2,500
	0		0	60	0	4,362	12	59	95	67	189	83	5,000
	0		0	187	0	12,004	27	197	181	251	265	258	10,000
Energy only 8 misses	0		0	0	0	29	0	0	2	15	10	0	0
	0		0	1	0	361	0	1	2	293	9	0	500
	0		0	2	0	746	1	0	1	595	11	2	1,000
	0		0	13	1	2,102	5	14	2	1,800	32	15	2,500
	0		0	59	1	4,597	6	57	4	3,900	53	44	5,000
	0		0	203	12	12,460	29	235	10	10,832	136	148	10,000
True DABS 16 misses	0	0	0	0	0	0	0	0		1	21	0	0
	0	153	0	1	0	283	0	0	11	214	23	1	500
	0	610	0	2	1	623	1	1	11	613	26	3	1,000
	0	1,891	0	17	0	1,863	3	18	12	1,810	37	16	2,500
	0	4,083	0	63	3	4,833	10	18	13	3,833	59	181	5,000
	0	11,197	0	219	1	11,028	13	226	19	10,690	156	218	10,000

TOTAL ERRORS FOR 75 SCANS

Lead edge option
Pseudo-lead edge option on

the energy only at two misses. The data collected were taken with pseudo-lead edge on and the lead edge options. Pseudo-lead edge, as proved by previous data, is necessary in the overlapped preamble cases to correctly decide preambles. The lead edge option was selected since the DABS national standard specifies a ±50 nanosecond maximum jitter for all pulses in the DABS message. The lead edge option covers that specification and causes less false decode errors than the P1 ±1 clock option.

A comparison between the sets of data indicates the same characteristics shown in the previous data. Error 1 (missed or late blanking) is increased at energy only with two misses. Error 2 is not significantly different from 2, 8, or 16 misses.

The following parameters were chosen based upon the preceding results: 4/4 lead edges, pseudo-lead edge on, P1 at the nominal lead edge position, and energy only at four misses. The option 4/4 lead edges gave the best overall performance in terms of detecting true preambles and eliminating false preambles. The energy only option required less misses, in general, than the true DABS option. The data indicated there were no significant changes between energy only with three misses and above. Decreasing the number of misses decreased the blank time after a DABS message. The value four was selected based upon the preamble timing. There is a 3 μs gap between the last preamble pulse and the beginning of the DABS message data block. A value of four will insure blanking beyond this gap when in an overlap situtation. All data collected during the DABS/ATCRBS compatibility tests involving the preamble detector were run with these preamble detector parameter values.

SUMMARY OF RESULTS

1. The addition of DABS fruit from 0 through 200 DABS fruit per second into the baseline ATCRBS 64 test target scenario at ATCRBS fruit rates from 0 to 10,000 fruit per second did not degrade percent detection of the ARTS III BDAS in the undefruited video configuration. System overloading at 400 DABS fruit and 10,000 ATCRBS fruit per second resulted in a 1.68 percent reduction in percent detection.

The increase in splits per scan by the addition of DABS fruit up to 400 DABS fruit per second is less than 0.4 per scan (1 per 2.5 scans) at all ATCRBS fruit rates when using undefruited video.

An increase in false alarms occurs with the addition of 200 DABS fruit per second at 1,000 ATCRBS fruit rates and above for undefruited video. The largest increase in false alarms was measured with 5,000 ATCRBS 400 DABS fruit per second. This combination resulted in 0.54 false alarms per scan compared to the baseline 0.18 per scan.

Code validation for the ARTS III BDAS in the undefruited video configuration was down slightly at the higher DABS and ATCRBS fruit rates. The largest measured effect was a 5 percent reduction in the number of correct codes detected at 10,000 ATCRBS and 400 DABS fruit per second. At 5,000 ATCRBS fruit per second and below there is no effect on code validation above 2 percent at any DABS fruit rate through 200 DABS fruit per second.

DABS fruit increases the amount of computer time necessary for beacon processing due to the detection of

ATCRBS brackets within the DABS messages. The percentage increase in processing time by the addition of 200 DABS fruit per second is approximately 6.4 percent. The increase in processing time for 100 DABS fruit per second is approximately 3.4 percent. This compares with the increase in processing time of 500 ATCRBS fruit per second, which is also approximately 3.4 percent.

BDAS processing overload alarms are increased by the addition of DABS fruit. The processor is in an overload condition with 10,000 ATCRBS fruit per second. Overloads occur at 5,000 ATCRBS and 10 DABS fruit per second. Overloads also occur at 2,500 ATCRBS and 75 DABS fruit per second.

2. The increase in splits, false alarms, and processing time is negligible by the addition of DABS fruit when a defruiter is implemented in the ARTS III system, even at reply probabilities of 0.70. Code validation is degraded less than 1.1 percent by the addition of 200 DABS fruit per second to the 10,000 ATCRBS fruit environment. At 10,000 ATCRBS and 100 DABS fruit per second the decrease in code validation is 0.8 percent.

All processing overload alarms are eliminated by the defruiter for all tested fruit rates.

3. The results of the implementation of the DABS preamble detector in the ARTS III system at all DABS fruit rates compare to the baseline undefruited ATCRBS environment results.

4. The maximum effect on percent detection for the SRAP occurred when using undefruited video with 10,000 ATCRBS and 400 DABS fruit per second. The addition of 400 DABS fruit per second caused a reduction in percent detection from baseline 99.93 to 91.94 percent. The maximum expected DABS fruit rate of 100 per second resulted in a maximum reduction of 0.36 percent at any of the tested ATCRBS fruit rates.

DABS fruit caused splits and false alarms to increase slightly with undefruited video. Splits are negligible in the baseline results. The addition of DABS fruit up to 200 fruit per second resulted in a maximum increase in splits of 0.08 per scan. False alarms were increased from 3.59 per scan to 5.93 per scan by the addition of 100 DABS fruit at 10,000 ATCRBS fruit per second.

SRAP overload alarms occur with the addition of as little as 10 DABS fruit per second.

5. The SRAP percent detection, split, false alarm, and code validation results were not significantly affected by the addition of DABS fruit rates up to the expected maximum rate when using defruited video. No overload alarms occur up to 100 DABS fruit per second. Overload alarms occur with the addition of 200 and 400 DABS fruit per second.

6. The DABS preamble detector eliminates the SRAP overload alarms caused by the addition of DABS fruit in the undefruited video configuration. The SRAP performance at all DABS fruit rates is unchanged from the baseline ATCRBS only environment when using the DABS preamble detector.

7. At a reduced reply probability of 0.70 the preamble detector configuration provided the best overall performance of the SRAP. Reduced reply probability caused the defruited video percent detection to drop from over 99 to approximately 94 percent. Code validation dropped from approximately 98 to 90 percent. The undefruited video results at 0.70 reply probability are very slightly degraded by the addition of 200 DABS fruit per second, about the same measured degradation as at 0.90 reply probability.

8. The ARTS II system performance was not degraded in percent detection, splits, and code validation in a DABS fruit environment. False alarms increased at 5,000 and 10,000 ATCRBS fruit rates as DABS fruit rates were increased. The largest increase in false alarms is only 0.42 per scan with the addition of 400 DABS at 10,000 ATCRBS fruit per second.

9. Reducing reply probability to 0.70 in the ARTS II system reduces percent detection from over 99 to 96 percent.

10. The AN/TPX-42 processor performance was not degraded by the addition of up to 400 DABS fruit per second. Percent detection and code validation remained at over 99 percent at all fruit rates.

11. Reducing reply probability of the test environment to 0.70 reduces percent detection of the AN/TPX-42 to approximately 92 percent. Split and code validation also decreased slightly. DABS fruit at the lower reply probabilities did not degrade the performance of the system when compared to the DABS fruit results at the same reply probabilities.

12. The addition of DABS fruit to the en route common digitizer had no effect upon percent detection, splits, and code validation. False alarms increase slightly at the higher ATCRBS fruit rates. The addition of 100 DABS fruit per second increases false alarms per scan to 1.55 from the 1.01 baseline result. At a 5,000 ATCRBS fruit rate, the false alarms increase to 0.06 per scan from the baseline 0.01 per scan with the addition of 100 DABS fruit per second.

13. Percent detection remained over 99 percent when reply probability was reduced to 0.70 for the common digitizer.

14. The DABS preamble detector criteria was optimized by evaluation of the various parameter selections available for true preamble detections and false preamble detections. The optimum parameter values were: (a) requires four of the four lead edges to be detected, (b) pseudo-lead edge insertion, (c) ±100 nanosecond lead edge criteria, and (d) 4 μs without pulse energy to turn off the blanking of a detected DABS preamble.

15. Spotlighting an ATCRBS parrot with a DABS antenna interrogating at the maximum rate with 40 DABS targets in the beam width, 10 targets interrogated each DABS period, plus 100 ATCRBS interrogations per second resulted in a 10 to 11 percent reduction in reply detection, but had no significant effect on the ARTS III ground station performance in target reports and track reliability.

16. Spotlighting with an ATCRBS interrogator with a PRF of 355 resulted in no degradation of parrot target detection.

CONCLUSIONS

1. The Automated Radar Terminal Systems (ARTS) III Beacon Data Acquisition Subsystem (BDAS) systems operating in the expected DABS fruit environment will not experience any system degradation when using defruited video. Those terminal facilities that use undefruited video will experience an increase in processor loadings which will decrease the overload point of the system. The use of a Discrete Address Beacon System (DABS) preamble detector in the undefruited video configuration will eliminate the effect of DABS fruit.

2. The ARTS IIIA sensor receiver and processor (SRAP) if implemented in the undefruited video configuration, will experience processor overloading in a DABS fruit environment. The DABS preamble detector eliminates the overloads.

3. A comparison of SRAP performance in the undefruited video, defruited video, and preamble detector configurations show that the undefruited video configuration performed better than defruited video in a DABS or no DABS fruit environment. In a DABS fruit environment the preamble detector has slightly better performance and eliminates all processing overloads through the range of fruit tested.

4. The addition of DABS fruit to the ARTS II will cause a very slight increase in false alarms at the higher ATCRBS fruit rate. Code validation and splits are affected slightly at higher ATCRBS fruit rates at the lower reply probabilities.

5. The AN/TPX-42 experienced no degradation in performance with the addition of DABS fruit.

6. The en route common digitizer experienced no degradation in performance with the addition of DABS fruit.

7. The DABS preamble detector operates satisfactorily in a DABS/ATCRBS environment.

8. The worst case suppression of a victim ATCRBS transponder due to a DABS interrogator results in a slight degradation to the reply detection of the reported target. Operation in a normal environment with DABS antenna rotating will cause no measurable degradation to a victim ACTRBS processor.

RECOMMENDATION

Implement a Discrete Address Beacon System (DABS) preamble detector for the Automated Terminal Radar Systems (ARTS) IIIA sensor receiver and processor (SRAP) systems which operate using undefruited video.

APPENDIX

DABS — ATCRBS COMPATIBILITY DATA RESULTS

LIST OF TABLES

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

TABLE A-1. ARTS III BDAS PERCENT DETECTION (UNDEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	99.81	99.82	99.18	99.13	99.24	99.42
10	99.18	99.16	99.20	99.20	99.24	99.39
20	99.68	99.24	99.26	99.23	99.22	98.81
40	99.22	99.23	99.20	99.66	99.25	98.70
75	99.90	99.84	99.24	99.20	99.75	98.65
100	99.90	99.14	99.24	99.75	99.19	99.23
200	99.17	99.15	99.15	99.23	99.20	98.41
400	99.83	99.14	99.48	99.17	99.20	97.74

TABLE A-2. ARTS III BDAS SPLITS PER SCAN (UNDEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0.11	0.20	0.22	0.34	0.77	3.05
10	0.13	0.09	0.22	0.38	0.93	3.55
20	0.07	0.13	0.20	0.49	0.57	3.03
40	0.11	0.21	0.17	0.33	0.64	3.19
75	0.11	0.20	0.19	0.32	0.44	3.03
100	0.15	0.19	0.28	0.70	0.88	2.97
200	0.31	0.36	0.27	0.53	0.84	2.95
400	0.48	0.47	0.49	0.77	1.11	2.81

TABLE A-3. ARTS III BDAS FALSE ALARMS PER SCAN (UNDEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0.18	2.01
10	0	0	0	0.03	0.15	1.95
20	0	0	0	0.01	0.18	2.12
40	0	0	0	0.01	0.23	2.26
75	0	0	0.01	0.01	0.25	1.95
100	0	0	0	0.03	0.25	2.06
200	0	0	0.01	0.02	0.25	2.12
400	0.01	0.01	0.02	0.09	0.54	1.99

TABLE A-4. ARTS III BDAS MODE 3/A CODE VALIDATION WITH CORRECT CODE (UNDEFRUITED)

DABS Fruit Rate	3/A Code Validity Value	0	0.5K	1.0K	2.5K	5.0K	10.0K
0	V_0	0	0	0.1	0	0.1	0.5
0	V_1	0.3	0.4	0.4	0.5	1.0	4.4
0	V_2	0	0	0	0.1	0.2	1.3
0	V_3	99.7	99.6	99.5	99.3	98.5	92.4
10	V_0	0	0	0	0	0	0.4
10	V_1	0.4	0.3	0.4	0.6	1.0	4.8
10	V_2	0	0	0	0.1	0.3	1.3
10	V_3	99.6	99.7	99.5	99.3	98.5	92.1
20	V_0	0	0	0	0	0	0.3
20	V_1	0.3	0.4	0.3	0.6	0.8	4.5
20	V_2	0	0	0	0.1	0.2	1.3
20	V_3	99.7	99.6	99.6	99.2	98.7	92.1
40	V_0	0	0	0	0	0.1	0.5
40	V_1	0.4	0.4	0.4	0.6	0.9	4.8
40	V_2	0	0	0	0.1	0.3	1.6
40	V_3	99.6	99.6	99.5	99.2	98.6	91.4
75	V_0	0	0	0	0	0	0.4
75	V_1	0.3	0.3	0.5	0.5	0.9	4.9
75	V_2	0	0	0.1	0.1	0.2	1.5
75	V_3	99.7	99.7	99.4	99.3	98.6	91.6
100	V_0	0	0	0	0	0.1	0.5
100	V_1	0.3	0.4	0.5	0.7	1.3	5.1
100	V_2	0	0	0	0.1	0.3	1.5
100	V_3	99.6	99.5	99.5	99.0	98.1	91.0
200	V_0	0	0	0	0	0.1	0.5
200	V_1	0.4	0.5	0.5	0.6	1.0	5.8
200	V_2	0	0	0	0.1	0.2	1.9
200	V_3	99.6	99.5	99.4	99.1	98.3	89.9
400	V_0	0	0	0	0.1	0.2	0.8
400	V_1	0.6	0.7	0.7	0.8	1.5	7.1
400	V_2	0	0	0.1	0.1	0.4	2.2
400	V_3	99.4	99.2	99.2	98.8	97.6	87.4

TABLE A-5. ARTS III BDAS MODE 3/A CODE VALIDATION WITH INCORRECT CODE (UNDEFRUITED)

DABS Fruit Rate	3/A Code Validity Value	0	0.5K	1.0K	2.5K	5.0K	10.0K
0	V_0	0	0	0	0	0	0.5
0	V_1	0	0	0	0.1	0.2	1.0
0	V_2	0	0	0	0	0	0
0	V_3	0	0	0	0	0	0
10	V_0	0	0	0	0	0.1	0.4
10	V_1	0	0	0	0	0.2	1.0
10	V_2	0	0	0	0	0	0
10	V_3	0	0	0	0	0	0
20	V_0	0	0	0	0	0.1	0.5
20	V_1	0	0	0	0	0.2	1.2
20	V_2	0	0	0	0	0	0
20	V_3	0	0	0	0	0	0
40	V_0	0	0	0	0	0.1	0.5
40	V_1	0	0	0	0	0.1	1.3
40	V_2	0	0	0	0	0	0
40	V_3	0	0	0	0	0	0
75	V_0	0	0	0	0	0.1	0.5
75	V_1	0	0	0	0	0.2	1.1
75	V_2	0	0	0	0	0	0
75	V_3	0	0	0	0	0	0
100	V_0	0	0	0	0	0.1	0.5
100	V_1	0	0	0	0.1	0.2	1.4
100	V_2	0	0	0	0	0	0
100	V_3	0	0	0	0	0	0
200	V_0	0	0	0	0	0.1	0.7
200	V_1	0	0	0	0.1	0.2	1.2
200	V_2	0	0	0	0	0	0
200	V_3	0	0	0	0	0	0
400	V_0	0	0	0	0	0.1	0.8
400	V_1	0	0	0	0.1	0.3	1.8
400	V_2	0	0	0	0	0	0
400	V_3	0	0	0	0	0	0

TABLE A-6. ARTS III BDAS PERCENT IOP TIME BEACON INPUT PROCESSING (UNDEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	14.4	17.8	21.4	33.3	53.4	86.1
10	14.7	18.1	21.7	33.3	53.5	87.1
20	15.1	18.5	22.2	33.8	54.1	85.8
40	15.8	19.2	22.9	34.7	54.7	86.0
75	16.9	20.5	24.1	35.9	56.5	85.8
100	17.8	21.4	25.1	37.1	57.3	86.2
200	20.8	24.5	28.4	40.3	60.7	85.7
400	28.6	32.5	36.6	48.6	68.8	83.4

TABLE A-7. ARTS III BDAS INPUT BUFFER OVERFLOWS PER SCAN (UNDEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	443.69
10	0	0	0	0	0.19	446.51
20	0	0	0	0	0.3	469.46
40	0	0	0	0	0.41	496.25
75	0	0	0	0.01	0.67	536.83
100	0	0	0	0.01	1.03	573.04
200	0	0	0	0.04	3.75	651.81
400	0.03	0.06	0.13	1.74	42.70	778.06

TABLE A-8. ARTS III BDAS DABS HARDWARE ERRORS PER SCAN (UNDEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	0
10	0	0	0	0	0	0
20	0	0	0	0	0	0
40	0	0	0	0	0	0
75	0	0	0	0	0	0
100	0	0	0	0	0	0
200	0	0	0	0.01	0	0
400	0	0	0	0	0	0.01

TABLE A-9. ARTS III BDAS REPORT TABLE OVERFLOWS PER SCAN (UNDEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	1.71
10	0	0	0	0	0	2.13
20	0	0	0	0	0	3.12
40	0	0	0	0	0	4.51
75	0	0	0	0	0	6.85
100	0	0	0	0	0	9.58
200	0	0	0	0	0.01	17.05
400	0	0	0	0.01	0.61	47.70

TABLE A-10. ARTS III BDAS PERCENT DETECTION (DEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	99.17	99.18	99.05	98.61	98.46	98.56
10	98.37	98.49	98.45	98.46	98.49	98.54
20	99.06	98.57	98.45	98.35	98.57	99.29
40	99.26	98.63	98.56	98.44	98.58	98.57
75	98.42	99.17	98.39	99.09	99.18	98.59
100	99.06	98.48	98.48	99.12	99.27	98.52
200	99.09	99.11	98.51	99.24	98.57	98.67
400	98.47	98.41	98.44	98.40	98.40	98.47

TABLE A-11. ARTS III BDAS SPLITS PER SCAN (DEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0.57	0.57	0.63	0.52	0.67	0.60
10	0.73	0.62	0.67	0.67	0.69	0.99
20	0.61	0.67	0.55	0.64	0.74	0.99
40	0.65	0.67	0.71	0.81	0.75	0.99
75	0.74	0.68	0.55	0.65	0.71	0.94
100	0.54	0.53	0.57	0.56	0.60	0.67
200	0.73	0.71	0.60	0.61	0.63	0.87
400	0.64	0.52	0.80	0.78	1.05	1.27

TABLE A-12. ARTS III BDAS FALSE ALARMS/SCAN (DEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	0.05
10	0	0	0	0	0	0.07
20	0	0	0	0	0	0.05
40	0	0	0	0	0	0.12
75	0	0	0	0	0	0.08
100	0	0	0	0	0	0.12
200	0	0	0	0.01	0.01	0.20
400	0	0	0	0.03	0.12	0.80

TABLE A-13. ARTS III BDAS PERCENT IOP TIME BEACON INPUT PROCESSING (DEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	14.1	14.1	14.1	14.2	14.4	15.4
10	14.0	14.3	14.3	14.3	14.3	15.7
20	14.0	14.2	14.3	14.1	14.6	15.6
40	14.0	14.0	14.3	14.1	14.7	15.7
75	14.1	14.1	14.3	14.2	14.6	16.3
100	14.0	14.1	14.4	14.3	14.7	16.3
200	14.1	14.2	14.5	14.4	15.1	16.9
400	14.5	14.6	14.6	15.4	16.7	20.1

TABLE A-14. ARTS III BDAS INPUT BUFFER OVERFLOWS, DAS HARDWARE ERRORS, REPORT TABLE OVERFLOWS PER SCAN (DEFRUITED)

Table Omitted — No Input Buffer Overflows, DAS Hardware Errors or Report Table Overflows were Detected for All DABS (0 to 1.0K) and ATCRBS (0 to 10.0K) Fruit Rates Tested.

TABLE A-15. ARTS III BDAS CODE VALIDATION WITH CORRECT CODE (DEFRUITED)

DABS Fruit Rate	3/A Code Validity Value	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	V_0	0	0	0	0	0.1	0.2
0	V_1	2.6	2.9	2.9	3.0	3.1	3.1
0	V_2	0	0	0	0	0.1	0.4
0	V_3	96.9	96.7	96.6	96.3	96.2	95.4
10	V_0	0	0	0	0.2	0	0.2
10	V_1	2.9	2.6	2.6	2.9	2.9	3.3
10	V_2	0	0	0	0.1	0.1	0.3
10	V_3	96.7	96.9	97.0	96.6	96.1	95.2
20	V_0	0	0	0	0	0	0.2
20	V_1	2.5	2.8	2.7	3.1	3.3	3.4
20	V_2	0	0	0	0	0.1	0.4
20	V_3	97.2	96.8	96.9	96.4	95.8	95.0
40	V_0	0	0	0	0	0.1	0.2
40	V_1	2.9	2.9	3.0	3.3	3.0	3.7
40	V_2	0	0	0	0.1	0.1	0.4
40	V_3	96.7	96.6	96.4	96.0	96.1	94.8
75	V_0	0	0	0	0	0	0.2
75	V_1	3.0	3.1	2.9	2.8	2.9	3.4
75	V_2	0	0	0	0.1	0.1	0.3
75	V_3	96.5	96.4	96.6	96.5	96.3	95.0
100	V_0	0	0	0	0	0	0.2
100	V_1	2.9	2.9	2.9	2.9	3.3	3.7
100	V_2	0	0	0	0	0.1	0.4
100	V_3	96.7	96.6	96.5	96.5	95.9	94.6
200	V_0	0	0	0	0	0.1	0.3
200	V_1	3.0	2.9	3.0	2.9	3.4	3.6
200	V_2	0	0	0	0	0.1	0.5
200	V_3	96.4	96.5	96.4	96.4	95.8	94.3
400	V_0	0	0	0	0	0.1	0.2
400	V_1	2.9	3.3	3.8	3.2	3.3	4.2
400	V_2	0	0	0	0.1	0.1	0.4
400	V_3	96.3	96.2	95.3	96.0	95.3	93.7

TABLE A-16. ARTS III BDAS CODE VALIDATION WITH INCORRECT CODE (DEFRUITED)

DABS Fruit Rate	3/A Code Validity Value	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	V_0	0.5	0.3	0.5	0.5	0.3	0.4
0	V_1	0	0	0	0.1	0.2	0.4
0	V_2	0	0	0	0	0	0
0	V_3	0	0	0	0	0.1	0.1
10	V_0	0.5	0.5	0.4	0.3	0.5	0.4
10	V_1	0	0	0	0.1	0.2	0.5
10	V_2	0	0	0	0	0	0
10	V_3	0	0	0	0	0.1	0.2
20	V_0	0.4	0.4	0.4	0.4	0.5	0.5
20	V_1	0	0	0	0.1	0.2	0.4
20	V_2	0	0	0	0	0	0
20	V_3	0	0	0	0	0.1	0.1
40	V_0	0.4	0.4	0.5	0.4	0.5	0.4
40	V_1	0	0	0	0.2	0.2	0.3
40	V_2	0	0	0	0	0	0
40	V_3	0	0	0	0	0.1	0.2
75	V_0	0.4	0.4	0.4	0.5	0.4	0.5
75	V_1	0	0.1	0.1	0.1	0.2	0.5
75	V_2	0	0	0	0	0	0
75	V_3	0	0	0	0.1	0.1	0.2
100	V_0	0.3	0.4	0.4	0.4	0.4	0.4
100	V_1	0	0.1	0.2	0.1	0.2	0.7
100	V_2	0	0	0	0	0	0
100	V_3	0	0	0	0.1	0.1	0.1
200	V_0	0.5	0.5	0.5	0.4	0.4	0.5
200	V_1	0.1	0.1	0.1	0.2	0.2	0.6
200	V_2	0	0	0	0	0	0
200	V_3	0	0	0	0	0.1	0.2
400	V_0	0.6	0.4	0.5	0.4	0.5	0.6
400	V_1	0.2	0.2	0.3	0.3	0.6	0.8
400	V_2	0	0	0	0	0	0
400	V_3	0	0.2	0	0	0.1	0.2

TABLE A-17. ARTS III BDAS PERCENT DETECTION (PREAMBLE DETECTOR)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	99.91	99.27	99.24	99.90	99.89	98.59
10	99.80	99.22	99.25	99.87	99.19	98.63
20	99.19	99.88	99.88	99.20	99.20	98.85
40	99.92	99.20	99.19	99.88	99.18	98.80
75	99.19	99.20	99.20	99.17	99.18	98.77
100	99.48	99.22	99.20	99.09	99.22	98.75
200	99.18	99.22	99.24	99.85	99.23	98.72
400	99.11	99.14	99.11	99.12	99.78	98.71

TABLE A-18. ARTS III BDAS SPLITS PER SCAN (PREAMBLE DETECTOR)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0.14	0.19	0.27	0.55	1.11	3.41
10	0.05	0.19	0.26	0.54	1.03	3.79
20	0.10	0.23	0.27	0.58	0.91	3.59
40	0.11	0.12	0.27	0.47	0.75	3.05
75	0.09	0.18	0.21	0.36	0.53	2.77
100	0.13	0.21	0.17	0.33	0.51	2.70
200	0.13	0.19	0.25	0.36	0.43	2.67
400	0.17	0.20	0.30	0.39	0.60	2.68

TABLE A-19. ARTS III BDAS FALSE ALARMS PER SCAN (PREAMBLE DETECTOR)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0.01	0.19	1.83
10	0	0	0	0.02	0.15	2.02
20	0	0	0	0.01	0.19	2.08
40	0	0	0	0.01	0.13	1.89
75	0	0	0	0	0.15	1.88
100	0	0	0	0.01	0.13	1.87
200	0	0	0	0.02	0.11	1.91
400	0	0	0	0	0.13	2.17

TABLE A-20. ARTS III BDAS PERCENT IOP TIME BEACON INPUT PROCESSING (PREAMBLE DETECTOR)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	14.4	17.8	21.4	33.2	53.6	85.7
10	14.4	18.0	21.7	33.2	53.5	85.7
20	14.4	17.8	21.5	33.4	53.4	85.5
40	14.4	18.1	21.6	33.1	53.3	85.7
75	14.3	17.7	21.3	33.1	53.2	85.7
100	14.4	17.7	21.3	32.9	52.8	85.8
200	14.4	17.7	21.6	32.8	52.5	85.9
400	14.3	17.9	21.5	32.3	52.1	85.4

TABLE A-21. ARTS III BDAS INPUT BUFFER OVERFLOWS PER SCAN (PREAMBLE DETECTOR)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0.16	446.16
10	0	0	0	0	0.15	441.71
20	0	0	0	0	0.15	438.83
40	0	0	0	0	0.20	428.85
75	0	0	0	0	0.14	420.80
100	0	0	0	0	0.21	415.30
200	0	0	0	0	0.17	393.01
400	0	0	0	0	0.15	346.20

TABLE A-22. ARTS III BDAS DAS HARDWARE ERRORS PER SCAN (PREAMBLE DETECTOR)

Table Omitted — No Hardware Errors Detected for all DABS (0 to 1.0K) and ATCRBS (0 to 10.0 K) Fruit Rates

TABLE A-23. ARTS III BDAS REPORT TABLE OVERFLOWS PER SCAN (PREAMBLE DETECTOR)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	1.67
10	0	0	0	0	0	1.56
20	0	0	0	0	0	1.65
40	0	0	0	0	0	1.41
75	0	0	0	0	0	1.53
100	0	0	0	0	0	1.56
200	0	0	0	0	0	1.52
400	0	0	0	0	0	0.94

TABLE A-24. ARTS III BDAS CODE VALIDATION WITH CORRECT CODE (PREAMBLE DETECTOR)

DABS Fruit Rate	Code Validity Value	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	V_0	0	0	0	0	0	0
0	V_1	0.3	0.4	0.5	0.7	1.0	4.5
0	V_2	0	0	0	0.1	0.3	1.1
0	V_3	99.6	99.6	99.5	99.2	98.5	92.2
10	V_0	0	0	0	0	0.1	0.5
10	V_1	0.2	0.4	0.4	0.6	1.4	4.5
10	V_2	0	0	0.1	0.1	0.3	1.2
10	V_3	99.7	99.6	99.5	99.5	98.1	92.1
20	V_0	0	0	0	0	0.1	0.4
20	V_1	0.3	0.3	0.4	0.6	0.9	4.5
20	V_2	0	0	0	0.1	0.2	1.3
20	V_3	99.7	99.7	99.5	99.2	98.7	91.8
40	V_0	0	0	0	0	0.1	0.3
40	V_1	0.3	0.3	0.4	0.6	0.7	4.2
40	V_2	0	0	0	0.1	0.2	1.0
40	V_3	99.7	99.6	99.5	99.3	98.8	93.0
75	V_0	0	0	0	0	0.1	0.4
75	V_1	0.3	0.4	0.4	0.7	1.1	4.3
75	V_2	0	0	0	0.1	0.2	1.0
75	V_3	99.7	99.6	99.6	98.7	98.3	92.5
100	V_0	0	0	0	0	0	0.4
100	V_1	0.4	0.5	0.5	0.7	1.1	4.0
100	V_2	0	0	0.1	0	0.1	1.2
100	V_3	99.6	99.5	99.5	99.2	98.5	92.7
200	V_0	0	0	0	0.1	0	0.5
200	V_1	0.4	0.4	0.6	0.6	1.0	4.2
200	V_2	0	0	0.1	0.1	0.3	1.1
200	V_3	99.6	99.6	99.3	99.1	98.5	92.5
400	V_0	0	0	0	0	0.1	0.4
400	V_1	0.4	0.6	0.4	0.7	1.1	4.2
400	V_2	0	0	0.1	0.1	0.4	1.2
400	V_3	99.6	99.4	99.5	99.0	98.2	92.5

TABLE A-25. ARTS III BDAS CODE VALIDATION WITH INCORRECT CODE (PREAMBLE DETECTOR)

DABS Fruit Rate	Code Validity Value	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	V_0	0	0	0	0	0	0.3
0	V_1	0	0	0	0	0.1	1.4
0	V_2	0	0	0	0	0	0
0	V_3	0	0	0	0	0	0
10	V_0	0	0	0	0	0	0.4
10	V_1	0	0	0	0	0.2	1.3
10	V_2	0	0	0	0	0	0
10	V_3	0	0	0	0	0	0
20	V_0	0	0	0	0	0	0.5
20	V_1	0	0	0	0.1	0.1	1.4
20	V_2	0	0	0	0	0	0
20	V_3	0	0	0	0	0	0
40	V_0	0	0	0	0	0.1	0.4
40	V_1	0	0	0	0.1	0.1	1.2
40	V_2	0	0	0	0	0	0
40	V_3	0	0	0	0	0	0
75	V_0	0	0	0	0.1	0.1	0.5
75	V_1	0	0	0	0	0.2	1.3
75	V_2	0	0	0	0	0	0
75	V_3	0	0	0	0	0	0
100	V_0	0	0	0	0	0.1	0.4
100	V_1	0	0	0	0.1	0.2	1.1
100	V_2	0	0	0	0	0	0
100	V_3	0	0	0	0	0	0
200	V_0	0	0	0	0	0	0.4
200	V_1	0	0	0	0.1	0.1	1.2
200	V_2	0	0	0	0	0	0
200	V_3	0	0	0	0	0	0
400	V_0	0	0	0	0	0.1	0.4
400	V_1	0	0	0	0	0.2	1.2
400	V_2	0	0	0	0	0	0
400	V_3	0	0	0	0	0.1	0.4

TABLE A-26. ARTS IIIA SRAP PERCENT DETECTION (UNDEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	99.94	99.96	99.95	99.96	99.96	99.93
10	99.84	99.90	99.88	99.87	99.91	99.78
20	99.94	99.92	99.89	99.91	99.87	99.90
40	99.84	99.78	99.88	99.85	99.83	99.78
75	99.84	99.69	99.67	99.74	99.73	99.58
100	99.85	99.80	99.73	99.82	99.60	99.83
200	99.40	99.60	99.51	99.43	99.24	98.24
400	98.32	98.51	98.11	97.25	96.34	91.94

TABLE A-27. ARTS IIIA SRAP SPLITS PER SCAN (UNDEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	0.03
10	0	0	0	0	0.02	0.04
20	0	0.01	0	0	0.01	0.06
40	0	0.01	0.01	0.01	0.01	0.08
75	0	0	0	0.01	0.02	0.05
100	0.01	0	0	0.01	0.01	0.11
200	0.02	0.01	0.01	0.03	0.04	0.09
400	0.09	0.05	0.10	0.19	0.11	0.25

TABLE A-28. ARTS IIIA SRAP FALSE ALARMS PER SCAN (UNDEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0.01	0.04	0.33	3.59
10	0	0	0.01	0.03	0.42	4.1
20	0	0	0.03	0.09	0.60	4.23
40	0	0.01	0.01	0.15	0.72	4.8
75	0.01	0.04	0.06	0.20	0.87	5.51
100	0.01	0.03	0.09	0.25	1.07	5.93
200	0.03	0.09	0.14	0.81	1.81	7.72
400	1.21	1.07	1.82	2.47	5.05	12.32

TABLE A-29. ARTS IIIA SRAP CODE VALIDATION WITH CORRECT CODE (UNDEFRUITED)

DABS Fruit Rate	Code Validity Value	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	V_0	0	0	0	0	0	0
0	V_1	0.04	0.06	0.10	0.13	0.19	0.33
0	V_2	0	0	0.01	0.02	0.04	0.07
0	V_3	99.96	99.94	99.89	99.84	99.71	99.36
10	V_0	0	0	0	0.01	0	0
10	V_1	0.10	0.10	0.10	0.16	0.24	0.39
10	V_2	0	0	0	0.01	0.02	0.03
10	V_3	99.90	99.90	99.89	99.79	99.65	99.36
20	V_0	0	0	0	0	0	0
20	V_1	0.11	0.12	0.11	0.18	0.23	0.39
20	V_2	0.01	0.01	0.03	0.02	0.01	0.02
20	V_3	99.87	99.86	99.85	99.78	99.70	99.31
40	V_0	0.07	0	0	0	0	0
40	V_1	0	0.07	0.07	0.13	0.17	0.34
40	V_2	0.01	0.02	0	0.02	0.05	0.01
40	V_3	99.91	99.88	99.89	99.83	99.69	99.26
75	V_0	0	0	0	0	0	0
75	V_1	0.06	0.11	0.17	0.14	0.25	0.39
75	V_2	0.02	0.01	0.02	0.01	0	0.04
75	V_3	99.90	99.86	99.78	99.82	99.68	99.34
100	V_0	0	0	0.01	0	0	0
100	V_1	0.11	0.10	0.12	0.14	0.19	0.61
100	V_2	0.02	0.06	0.02	0.02	0.01	0.09
100	V_3	99.85	99.78	99.84	99.76	99.70	98.86
200	V_0	0.01	0	0	0	0.02	0
200	V_1	0.09	0.12	0.15	0.20	0.20	0.77
200	V_2	0.05	0.01	0.07	0.02	0.03	0.07
200	V_3	99.84	99.84	99.75	99.70	99.63	98.76
400	V_0	0.01	0	0.02	0	0.02	0.02
400	V_1	0.34	0.35	0.43	0.44	0.77	1.64
400	V_2	0.17	0.08	0.10	0.11	0.09	
400	V_3	99.39	99.47	99.37	99.32	98.85	97.24

TABLE A-30. ARTS IIIA SRAP CODE VALIDATION WITH INCORRECT CODE (UNDEFRUITED)

DABS Fruit Rate	3/A Code Validity Value	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	V_0	0	0	0	0	0.01	0.01
0	V_1	0	0	0	0.01	0.03	0.12
0	V_2	0	0	0	0	0	0
0	V_3	0	0	0	0	0.01	0.11
10	V_0	0	0	0	0	0.02	0
10	V_1	0	0	0.01	0.02	0.03	0.09
10	V_2	0	0	0	0	0	0
10	V_3	0	0	0	0	0.03	0.13
20	V_0	0	0	0	0	0	0.01
20	V_1	0	0.02	0.02	0.02	0.04	0.15
20	V_2	0	0	0	0	0	0
20	V_3	0	0	0	0	0.02	0.12
40	V_0	0	0	0	0	0	0.01
40	V_1	0.01	0.01	0.02	0.02	0.03	0.24
40	V_2	0	0	0.01	0	0	0
40	V_3	0	0.02	0.01	0	0.05	0.14
75	V_0	0	0	0	0	0.02	0.01
75	V_1	0	0.01	0.01	0.03	0.05	0.17
75	V_2	0	0	0.01	0	0	0.01
75	V_3	0.01	0.01	0	0	0.01	0.03
100	V_0	0	0	0	0.01	0	0.01
100	V_1	0.01	0.04	0.01	0	0.09	0.30
100	V_2	0	0	0	0.06	0	0
100	V_3	0.01	0 .01	0	0.01	0.01	0.13
200	V_0	0	0.02	0	0	0.02	0.02
200	V_1	0	0.02	0.02	0.07	0.09	0.30
200	V_2	0	0	0	0	0	0
200	V_3	0.01	0	0.01	0.02	0.02	0.10
400	V_0	0	0	0	0	0.03	0.06
400	V_1	0.06	0	0	0	0	0
400	V_2	0.01	0.10	0.08	0.12	0.21	0.71
400	V_3	0	0	0	0.01	0.02	0.08

TABLE A-31. ARTS IIIA SRAP INPUT FIFO ALARMS PER SCAN (UNDEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	0
10	1.8	1.7	1.8	1.8	1.9	2.3
20	4.8	4.5	4.7	5.1	4.8	6.0
40	9.0	8.8	8.7	9.2	9.2	10.9
75	16.5	15.5	16.4	16.4	16.5	18.5
100	20.2	20.4	20.2	20.4	20.4	23.9
200	27.8	27.2	27.5	27.3	28.8	33.7
400	38.8	38.4	38.9	39.2	40.4	46.1

TABLE A-32. ARTS IIIA SRAP BUFFER OVERFLOWS PER SCAN (UNDEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	0
10	0	0	0	0	0	0.01
20	0	0	0	0.07	0	0.05
40	0	0	0.01	0.03	0.1	0.5
75	0.1	0.2	0.4	0.2	0.4	1.4
100	0.2	0.3	0.2	0.1	1.1	2.9
200	1.0	0.7	0.9	1.3	2.7	8.9
400	4.1	4.1	6.1	7.9	14.0	26.8

TABLE A-33. ARTS IIIA SRAP PERCENT DETECTION (DEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	99.43	99.43	99.40	99.38	99.40	99.39
10	99.42	99.40	99.38	99.39	99.39	99.37
20	99.37	99.42	99.37	99.41	99.44	99.42
40	99.42	99.41	99.38	99.41	99.42	99.44
75	99.39	99.42	99.39	99.42	99.45	99.45
100	99.42	99.40	99.40	99.28	99.40	99.43
200	99.33	99.42	99.44	99.47	99.40	99.40
400	99.43	99.43	99.40	99.44	99.44	99.45

TABLE A-34. ARTS IIIA SRAP SPLITS PER SCAN (DEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0.03	0.03	0.03	0.03	0.03	0.03
10	0.03	0.04	0.04	0.03	0.03	0.06
20	0.03	0.03	0.03	0.03	0.03	0.05
40	0.03	0.03	0.03	0.03	0.03	0.03
75	0.03	0.03	0.03	0.03	0.03	0.05
100	0.03	0.03	0.04	0.03	0.04	0.04
200	0.03	0.03	0.03	0.04	0.04	0.07
400	0.03	0.04	0.05	0.05	0.05	0.08

TABLE A-35. ARTS IIIA SRAP FALSE ALARMS PER SCAN (DEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0.01	0.01	0.05
10	0	0	0	0.01	0.01	0.11
20	0	0	0	0	0.01	0.07
40	0	0	0	0	0.03	0.09
75	0	0.01	0.01	0.01	0.01	0.11
100	0	0.01	0	0.03	0.03	0.11
200	0.01	0	0.01	0.02	0.06	0.18
400	0.53	0.02	0.05	0.07	0.11	0.53

TABLE A-36. ARTS IIIA SRAP CODE VALIDATION WITH CORRECT CODE (DEFRUITED)

DABS Fruit Rate	3/A Code Validity Value	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	V_0	0	0	0	0.01	0.01	0.03
0	V_1	1.23	1.24	1.24	1.30	1.36	1.76
0	V_2	0	0	0.01	0.01	0.09	0.16
0	V_3	98.58	98.57	98.53	98.33	98.16	97.32
10	V_0	0	0	0	0	0.02	0.04
10	V_1	1.23	1.22	1.29	1.34	1.42	1.69
10	V_2	0	0	0.02	0.01	0.08	0.21
10	V_3	98.57	98.55	98.42	98.38	98.12	97.32
20	V_0	0	0	0.01	0.01	0.01	0.08
20	V_1	1.17	1.22	1.17	1.39	1.37	1.65
20	V_2	0	0	0	0.06	0.08	0.31
20	V_3	98.64	98.59	98.58	98.26	98.18	97.33
40	V_0	0	0	0.01	0	0	0.08
40	V_1	1.19	1.20	1.16	1.34	1.45	1.57
40	V_2	0	0.01	0	0.02	0.12	0.32
40	V_3	98.64	98.54	98.58	98.37	98.04	97.48
75	V_0	0	0	0	0	0	0.06
75	V_1	1.16	1.20	1.20	1.33	1.43	1.74
75	V_2	0	0	0	0.02	0.13	0.30
75	V_3	98.56	98.44	98.46	98.34	97.93	97.13
100	V_0	0	0	0	0	0.04	0.21
100	V_1	1.26	1.28	1.28	1.31	1.52	1.74
100	V_2	0	0	0.02	0.03	0.06	0.31
100	V_3	98.51	98.52	98.40	98.30	98.00	97.23
200	V_0	0.01	0	0.01	0	0.02	0.10
200	V_1	1.27	1.35	1.32	1.44	1.43	1.76
200	V_2	0.01	0.02	0.01	0.04	0.08	0.27
200	V_3	98.48	98.35	98.39	98.17	98.00	96.91
400	V_0	0	0.02	0.01	0.01	0.01	0.08
400	V_1	1.39	1.36	1.52	1.56	1.54	2.00
400	V_2	0.04	0.04	0.06	0.14	0.16	0.33
400	V_3	98.20	98.24	98.02	97.80	97.64	96.85

TABLE A-37. ARTS IIIA SRAP CODE VALIDATION WITH INCORRECT CODE (DEFRUITED)

DABS Fruit Rate	3/A Code Validity Value	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	V_0	0.18	0.18	0.18	0.18	0.18	0.16
0	V_1	0	0	0.01	0.05	0.10	0.35
0	V_2	0	0	0	0	0	0.01
0	V_3	0	0	0.02	0.11	0.10	0.21
10	V_0	0.18	0.18	0.18	0.18	0.18	0.18
10	V_1	0.01	0.03	0.03	0.03	0.10	0.37
10	V_2	0	0	0	0	0	0
10	V_3	0	0.01	0.05	0.05	0.09	0.19
20	V_0	0.18	0.18	0.18	0.17	0.15	0.19
20	V_1	0	0	0.04	0.08	0.15	0.31
20	V_2	0	0	0	0	0	0
20	V_3	0.01	0	0.01	0.02	0.05	0.12
40	V_0	0.17	0.18	0.18	0.17	0.19	0.19
40	V_1	0	0.04	0.03	0.06	0.12	0.25
40	V_2	0	0	0	0	0	0
40	V_3	0	0.02	0.03	0.03	0.08	0.11
75	V_0	0.24	0.24	0.24	0.23	0.26	0.27
75	V_1	0.04	0.10	0.08	0.05	0.15	0.34
75	V_2	0	0	0	0	0	0
75	V_3	0	0.02	0.02	0.02	0.10	0.15
100	V_0	0.18	0.18	0.18	0.17	0.17	0.21
100	V_1	0.04	0.02	0.09	0.11	0.10	0.31
100	V_2	0	0	0	0.01	0.01	0
100	V_3	0	0	0.03	0.06	0.09	0.25
200	V_0	0.16	0.17	0.16	0.18	0.18	0.17
200	V_1	0.06	0.10	0.10	0.09	0.16	0.52
200	V_2	0	0	0	0.01	0	0
200	V_3	0	0.01	0.01	0.06	0.13	0.27
400	V_0	0.17	0.19	0.19	0.17	0.13	0.18
400	V_1	0.18	0.14	0.15	0.27	0.41	0.44
400	V_2	0	0	0	0.01	0.02	0.01
400	V_3	0.01	0	0.03	0.04	0.08	0.11

AD-A138 414 DISCRETE ADDRESS BEACON SYSTEM (DABS)/AIR TRAFFIC CONTROL RADAR BEACON SY..(U) FEDERAL AVIATION ADMINISTRATION TECHNICAL CENTER ATLANTIC CIT.. L WAPELHORST ET AL. SEP 81 DOT/FAA/CT-81-27 F/G 17/7

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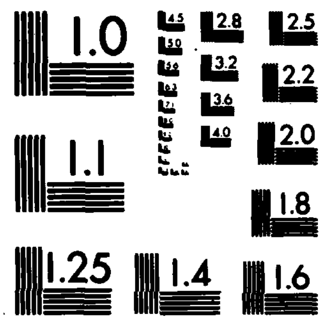

MICROCOPY RESOLUTION TEST CHART
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TABLE A-38. ARTS IIIA SRAP INPUT FIFO ALARMS PER SCAN (DEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	0
10	0	0	0	0	0	0
20	0	0	0	0	0	0
40	0	0	0	0	0	0
75	0	0	0	0	0	0
100	0.01	0	0	0	0	0
200	0.20	0	0	0.24	0.26	0.15
400	1.40	0.77	0.94	1.68	0.90	1.01

TABLE A-39. ARTS IIIA SRAP BUFFER OVERFLOWS PER SCAN (DEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	0
10	0	0	0	0	0	0
20	0	0	0	0	0	0
40	0	0	0	0	0	0
75	0	0	0	0	0	0
100	0	0	0	0	0	0
200	0	0	0	0	0	0
400	0	0	0	0	0	0

TABLE A-40. ARTS IIIA PERCENT DETECTION (PREAMBLE DETECTOR)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	99.90	99.87	99.90	99.89	99.86	99.91
10	99.87	99.86	99.91	99.88	99.87	99.83
20	99.87	99.91	99.89	99.84	99.90	99.87
40	99.90	99.91	99.90	99.85	99.90	99.88
75	99.94	99.94	99.82	99.92	99.92	99.91
100	99.86	99.88	99.82	99.89	99.86	99.89
200	99.89	99.89	99.86	99.87	99.86	99.89
400	99.82	99.87	99.85	99.82	99.83	99.82

TABLE A-41. ARTS IIA SRAP SPLITS PER SCAN (PREAMBLE DETECTOR)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0.01	0.01	0.01	0.01	0.01	0.03
10	0	0	0.01	0.01	0.03	0.13
20	0	0.01	0.01	0.01	0.01	0.07
40	0	0	0.01	0.01	0.01	0.03
75	0	0	0.01	0	0.02	0.07
100	0	0	0.01	0.01	0.03	0.03
200	0	0	0	0.01	0.02	0.06
400	0	0	0	0	0.01	0.02

TABLE A-42. ARTS IIIA SRAP FALSE ALARMS PER SCAN (PREAMBLE DETECTOR)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0.01	0.06	0.42	3.96
10	0	0	0.01	0.07	0.41	3.84
20	0	0	0	0.07	0.41	3.65
40	0	0	0	0.08	0.40	3.73
75	0	0	0.01	0.11	0.24	4.18
100	0	0	0.01	0.04	0.43	3.59
200	0	0	0	0.05	0.41	3.80
400	0	0	0	0.05	0.43	3.42

TABLE A-43. ARTS IIIA SRAP CODE VALIDATION WITH CORRECT CODE (PREAMBLE DETECTOR)

DABS Fruit Rate	3/A Code Validity Value	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	V_0	0	0	0	0	0	0
0	V_1	0.05	0.10	0.09	0.05	0.19	0.26
0	V_2	0	0	0.01	0.03	0.03	0.05
0	V_3	99.95	99.89	99.89	99.89	99.68	99.47
10	V_0	0	0	0	0	0	0
10	V_1	0.05	0.08	0.09	0.11	0.18	0.35
10	V_2	0	0	0.01	0.01	0.03	0.06
10	V_3	99.95	99.91	99.89	99.85	99.69	99.22
20	V_0	0	0	0	0	0	0
20	V_1	0.10	0.10	0.12	0.16	0.18	0.45
20	V_2	0	0.01	0.01	0.01	0.01	0.01
20	V_3	99.89	99.89	99.86	99.82	99.77	99.24
40	V_0	0	0	0	0	0	0
40	V_1	0.06	0.11	0.05	0.08	0.17	0.32
40	V_2	0	0.01	0.01	0.02	0.02	0.05
40	V_3	99.92	99.88	99.92	99.87	99.76	99.27
75	V_0	0	0	0	0	0	0
75	V_1	0.06	0.08	0.09	0.09	0.17	0.39
75	V_2	0	0.01	0.01	0.04	0.06	0.03
75	V_3	99.94	99.88	99.88	99.85	99.71	99.25
100	V_0	0	0	0	0	0.01	0
100	V_1	0.06	0.06	0.12	0.10	0.17	0.32
100	V_2	0	0	0	0.02	0.02	0.04
100	V_3	99.92	99.94	99.83	99.83	99.68	99.52
200	V_0	0	0	0	0	0	0
200	V_1	0.06	0.08	0.05	0.10	0.15	0.40
200	V_2	0	0.01	0.01	0.02	0.02	0.06
200	V_3	99.94	99.91	99.92	99.85	99.75	99.18
400	V_0	0	0	0	0.01	0	0
400	V_1	0.09	0.15	0.11	0.11	0.20	0.41
400	V_2	0.01	0.02	0.02	0.03	0.05	0.40
400	V_3	99.89	99.82	99.86	99.80	99.68	99.30

TABLE A-44. ARTS IIIA SRAP CODE VALIDATION WITH INCORRECT CODE (PREAMBLE DETECTOR)

DABS Fruit Rate	3/A Code Validity Value	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	V_0	0	0	0	0	0	0.01
0	V_1	0	0	0.01	0	0.03	0.12
0	V_2	0	0	0	0.02	0	0
0	V_3	0	0.01	0	0	0.06	0.09
10	V_0	0	0	0	0	0	0.03
10	V_1	0	0.01	0	0.03	0.08	0.17
10	V_2	0	0	0	0	0	0
10	V_3	0	0	0	0	0.02	0.16
20	V_0	0	0	0	0	0	0
20	V_1	0	0	0	0.01	0.02	0.17
20	V_2	0	0	0	0	0	0
20	V_3	0.01	0	0.01	0	0.01	0.13
40	V_0	0	0	0	0	0.01	0.01
40	V_1	0	0	0.01	0.02	0.02	0.17
40	V_2	0	0	0	0	0	0
40	V_3	0.01	0	0	0.01	0.01	0.17
75	V_0	0	0	0	0	0	0
75	V_1	0	0.01	0.01	0.02	0.05	0.17
75	V_2	0	0	0	0	0	0
75	V_3	0	0.02	0.10	0	0	0.16
100	V_0	0	0	0	0	0.01	0.01
100	V_1	0	0	0.02	0.03	0.04	0.08
100	V_2	0	0	0	0	0	0
100	V_3	0.01	0	0.03	0.02	0.06	0.03
200	V_0	0	0	0	0	0	0.01
200	V_1	0	0	0.01	0.02	0.05	0.24
200	V_2	0	0	0	0	0	0
200	V_3	0	0	0	0.01	0.02	0.11
400	V_0	0	0	0	0.01	0	0.02
400	V_1	0	0.01	0.01	0.04	0.04	0.20
400	V_2	0	0	0	0	0	0
400	V_3	0.01	0	0	0	0.02	0.02

TABLE A-45. ARTS II PERCENT DETECTION

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	99.58	99.58	99.58	99.61	99.60	99.59
10	99.60	99.63	99.60	99.62	99.61	99.57
20	99.58	99.59	99.59	99.60	99.60	99.59
40	99.69	99.59	99.65	99.61	99.60	99.61
75	99.57	99.58	99.57	99.60	99.60	99.57
100	99.60	99.62	99.63	99.62	99.65	99.70
200	99.59	99.58	99.62	99.60	99.63	99.59
400	99.50	99.61	99.57	99.63	99.59	99.66

TABLE A-46. ARTS II SPLITS PER SCAN

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0.01	0.01	0.02
10	0	0	0	0	0.01	0.01
20	0	0	0	0.01	0	0.05
40	0	0	0	0.01	0	0.03
75	0	0	0	0	0	0.02
100	0	0	0	0.01	0.01	
200	0	0	0	0	0.01	0.04
400	0.01	0	0	0.01	0	0.07

TABLE A-47. ARTS II FALSE ALARMS PER SCAN

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	0.11
10	0	0	0	0	0	0.17
20	0	0	0	0	0.01	0.17
40	0	0	0	0	0.01	0.13
75	0	0	0	0	0.01	0.21
100	0	0	0	0	0.01	0.21
200	0	0	0	0.01	0.03	0.33
400	0	0	0	0.04	0.07	0.53

TABLE A-48. ARTS II CODE VALIDATION WITH CORRECT CODE

DABS Fruit Rate	3/A Code Validity Value	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	V_0	0	0	0	0	0	0
0	V_1	1.4	1.6	1.4	1.6	1.4	1.7
0	V_2	0	0	0	0	0	0
0	V_3	98.3	98.3	98.3	98.1	98.1	97.5
10	V_0	0	0	0	0	0	0
10	V_1	1.4	1.6	1.4	1.6	1.5	1.6
10	V_2	0	0	0	0	0	0.1
10	V_3	98.3	98.0	98.1	97.9	98.0	97.6
20	V_0	0	0	0	0	0	0
20	V_1	1.3	1.6	1.4	1.6	1.4	1.7
20	V_2	0	0	0	0	0	0.1
20	V_3	98.3	98.2	98.3	98.1	98.1	97.4
40	V_0	0	0	0	0	0	0
40	V_1	1.6	1.4	1.5	1.4	1.7	1.6
40	V_2	0	0	0	0	0	0.1
40	V_3	97.7	98.3	97.8	98.1	97.8	96.9
75	V_0	0	0	0	0	0	0
75	V_1	1.6	1.4	1.6	1.4	1.7	1.7
75	V_2	0	0	0	0	0.1	0
75	V_3	98.2	98.3	98.2	98.1	97.8	97.5
100	V_0	0	0	0	0	0	
100	V_1	1.4	1.6	1.4	1.6	1.5	
100	V_2	0	0	0	0	0.1	
100	V_3	98.2	98.1	98.2	98.1	98.0	
200	V_0	0	0	0	0	0	0
200	V_1	1.5	1.8	1.5	1.7	1.6	1.8
200	V_2	0	0	0	0	0	0.2
200	V_3	98.2	98.0	98.2	97.9	97.8	97.2
400	V_0	0	0	0	0	0	0
400	V_1	1.7	1.5	1.7	1.6	1.9	1.8
400	V_2	0	0	0	0	0.1	0.2
400	V_3	98.0	98.1	97.9	97.9	97.6	97.1

TABLE A-49. ARTS II 3/A CODE VALIDATION WITH INCORRECT CODES

DABS Fruit Rate	3/A Code Validity Value	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	V_0	0.3	0.2	0.3	0.2	0.4	0.4
0	V_1	0	0	0	0	0.1	0.1
0	V_2	0	0	0	0	0	0
0	V_3	0	0	0	0.1	0.1	0.1
10	V_0	0.3	0.2	0.3	0.2	0.3	0.3
10	V_1	0	0	0	0	0	0.2
10	V_2	0	0	0	0	0	0
10	V_3	0.1	0.2	0.1	0.3	0.1	0.2
20	V_0	0.3	0.2	0.3	0.2	0.3	0.3
20	V_1	0	0	0	0	0.1	0.2
20	V_2	0	0	0	0	0	0
20	V_3	0	0	0	0.1	0.1	0.2
40	V_0	0.2	0.3	0.2	0.3	0.2	0.5
40	V_1	0	0	0	0	0	0.2
40	V_2	0	0	0	0	0	0
40	V_3	0.5	0	0.4	0.2	0.2	0.7
75	V_0	0.2	0.3	0.2	0.3	0.2	0.5
75	V_1	0	0	0	0.2	0.2	0.2
75	V_2	0	0	0	0	0	0
75	V_3	0	0	0	0	0.1	0.1
100	V_0	0.3	0.2	0.3	0.2	0.3	
100	V_1	0	0	0	0	0.1	
100	V_2	0	0	0	0	0	
100	V_3	0.1	0	0	0	0	
200	V_0	0.3	0.2	0.3	0.2	0.4	0.4
200	V_1	0.1	0	0.1	0.1	0.1	0.3
200	V_2	0	0	0	0	0	0
200	V_3	0	0	0	0.1	0.1	0.1
400	V_0	0.2	0.3	0.2	0.4	0.2	0.4
400	V_1	0.1	0.1	0.1	0.2	0.2	0.4
400	V_2	0	0	0	0	0	0
400	V_3	0	0	0	0	0.1	0.1

TABLE A-50. TPX-42 PERCENT DETECTION (DEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	99.16	99.15	99.15	99.13	99.16	99.16
10	99.11	99.11	99.12	99.12	99.14	99.14
20	99.16	99.15	99.15	99.16	99.18	99.18
40	99.09	99.12	99.14	99.14	99.15	99.13
75	99.10	99.14	99.12	99.10	99.13	99.15
100	99.12	99.13	99.14	99.15	99.13	99.15
200	99.13	99.15	99.15	99.14	99.22	99.15
400	99.20	99.16	99.16	99.18	99.26	99.30

TABLE A-51. TPX-42 SPLITS PER SCAN (DEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0.01	0.01	0.01	0.01	0.01	0.04
10	0.02	0.02	0.02	0.04	0.04	0.09
20	0.01	0.01	0.01	0.01	0.01	0.05
40	0.02	0.02	0.03	0.02	0.02	0.05
75	0.02	0.02	0.02	0.03	0.04	0.06
100	0.02	0.02	0.02	0.03	0.02	0.07
200	0	0.01	0.01	0.01	0.03	0.10
400	0.01	0.01	0.01	0.03	0.09	0.14

TABLE A-52. TPX-42 FALSE ALARMS PER SCAN (DEFRUITED)

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	0.01
10	0	0.01	0	0	0	0.01
20	0	0	0.01	0	0.02	0
40	0.01	0.01	0	0.01	0	0.01
75	0	0	0	0	0.01	0.02
100	0	0	0	0	0	0.02
200	0	0	0	0	0	0.01
400	0	0.01	0	0.02	0	0.03

TABLE A-53. TPX-42 CODE VALIDATION WITH CORRECT CODE (DEFRUITED)

DABS Fruit Rate	Code Validation Bit	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	0	0
0	1	99.9	99.9	99.9	99.9	99.8	99.6
10	0	0	0	0	0	0	0
10	1	99.9	99.9	99.9	99.9	99.8	99.6
20	0	0	0	0	0	0	0
20	1	99.9	99.9	99.9	99.8	99.7	99.6
40	0	0	0	0	0	0	0
40	1	99.9	99.9	99.9	99.9	99.8	99.5
75	0	0	0	0	0	0	0.1
75	1	99.9	99.9	99.9	99.9	99.9	99.4
100	0	0	0	0	0	0	0
100	1	99.9	99.9	99.9	99.9	99.8	99.5
200	0	0	0	0	0	0	0.1
200	1	99.9	99.9	99.9	99.9	99.7	99.4
400	0	0	0	0	0	0	0
400	1	99.9	99.9	99.9	99.8	99.8	99.4

TABLE A-54. TPX-42 CODE VALIDATION WITH INCORRECT CODE (DEFRUITED)

DABS Fruit Rate	Code Validation Bit	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	0	0
0	1	0.1	0.1	0.1	0.1	0.2	0.3
10	0	0	0	0	0	0	0
10	1	0.1	0.1	0.1	0.1	0.2	0.4
20	0	0	0	0	0	0	0
20	1	0.1	0.1	0.1	0.2	0.3	0.4
40	0	0	0	0	0	0	0
40	1	0.1	0.1	0.1	0.1	0.2	0.5
75	0	0	0	0	0	0	0
75	1	0.1	0.1	0.1	0.1	0.1	0.5
100	0	0	0	0	0	0	0.1
100	1	0.1	0.1	0.1	0.1	0.2	0.4
400	0	0	0	0	0	0	0
400	1	0.1	0.1	0.1	0.2	0.2	0.6

TABLE A-55. COMMON DIGITIZER (AN/FYW-49) PERCENT DETECTION

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	99.99	99.99	99.98	99.99	99.99	99.91
10	99.99	99.98	99.99	99.97	99.99	99.98
20	99.98	99.97	100.00	99.98	100.00	99.95
40	99.98	100.00	99.98	99.99	99.98	99.97
75	99.98	99.98	99.98	99.98	100.00	100.00
100	99.98	99.99	99.99	99.98	100.00	99.98
200	99.99	99.98	99.98	99.97	99.99	99.99
400	99.99	99.98	100.00	99.97	100.00	99.99

TABLE A-56. COMMON DIGITIZER SPLITS PER SCAN

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0.01	0.30
10	0	0	0	0	0.01	0.25
20	0	0	0	0	0.02	0.23
40	0	0	0	0	0.01	0.21
75	0	0	0	0	0.01	0.23
100	0	0	0	0	0.01	0.28
200	0	0	0	0	0.02	0.31
400	0	0	0	0	0.01	0.32

TABLE A-57. COMMON DIGITIZER FALSE ALARMS PER SCAN

DABS Fruit Rate	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0.01	1.01
10	0	0	0	0	0.02	0.92
20	0	0	0	0.01	0.01	1.14
40	0	0	0	0	0.03	1.21
75	0	0	0	0	0.05	1.35
100	0	0	0	0.01	0.06	1.55
200	0	0	0.01	0.01	0.08	2.79
400	0	0	0	0.03	0.30	5.41

TABLE A-58. COMMON DIGITIZER MODE 3/A CODE VALIDATION WITH CORRECT CODE

DABS Fruit Rate	Code Validation Bit	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0						
0	1	100	100	100	100	100	99.7
10	0	0	0	0	0	0	0
10	1	100	100	100	100	100	99.8
20	0	0	0	0	0	0	0.1
20	1	100	100	100	100	100	99.8
40	0	0	0	0	0	0	0
40	1	100	100	100	100	100	99.8
75	0	0	0	0	0	0	0
75	1	100	100	100	100	100	99.80
100	0	0	0	0	0	0	0.1
100	1	100	100	100	100	100	99.7
200	0	0	0	0	0	0	0
200	1	100	100	100	100	100	99.2

TABLE A-59. COMMON DIGITIZER MODE 3/A CODE VALIDATION WITH INCORRECT CODE

DABS Fruit Rate	Code Validation Bit	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0	0	0.2
0	1	0	0	0	0	0	0.1
10	0	0	0	0	0	0	0.1
10	1	0	0	0	0	0	0.1
20	0	0	0	0	0	0	0.1
20	1	0	0	0	0	0	0
40	0	0	0	0	0	0	0.1
40	1	0	0	0	0	0	0.1
75	0	0	0	0	0	0	0.2
75	1	0	0	0	0	0	0
100	0	0	0	0	0	0	0.2
100	1	0	0	0	0	0	0
200	0	0	0	0	0	0	0.3
200	1	0	0	0	0	0	0
400	0	0	0	0	0	0	0
400	1	0	0	0	0	0	0.1

TABLE A-60. COMMON DIGITIZER MODE C CODE VALIDATION WITH CORRECT CODE

DABS Fruit Rate	Code Validation Bit	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0				0.1	0.2	0.3
0	1	100	100	100	99.9	99.8	99.4
10	0	0	0.1	0.1	0.1	0.1	0.3
20	0	0	0	0.1	0.1	0.1	0.3
20	1	100	100	99.9	99.9	99.8	99.4
40	0	0	0	0	0	0.1	0.4
40	1	100	100	100	100	99.8	99.3
75	0	0	0.1	0	0.1	0.2	0.3
75	1	100	99.9	100	99.9	99.8	99.3
100	0	0	0	0.1	0.1	0.2	0.4
100	1	100	100	99.9	99.9	99.7	99.1
200	0	0	0	0	0.1	0.1	0.3
200	1	100	100	100	99.9	99.8	99.2
400	0	0	0.1	0.1	0.1	0.2	0.5
400	1	100	99.9	99.9	99.9	99.8	99.1

TABLE A-61. COMMON DIGITIZER MODE C CODE VALIDATION WITH INCORRECT CODE

DABS Fruit Rate	Code Validation Bit	ATCRBS Fruit Rate 0	0.5K	1.0K	2.5K	5.0K	10.0K
0	0	0	0	0	0		0.3
0	1	0	0	0	0		0
10	0	0	0	0	0	0.1	0.3
10	1	0	0	0	0	0	0
20	0	0	0	0	0	0.1	0.3
20	1	0	0	0	0	0	0
40	0	0	0	0	0	0.1	0.3
40	1	0	0	0	0	0	0
75	0	0	0	0	0	0	0.3
75	1	0	0	0	0	0	0
100	0	0	0	0	0	0.1	0.4
100	1	0	0	0	0	0	0
200	0	0	0	0	0	0.1	0.4
200	1	0	0	0	0	0	0
400	0	0	0	0	0	0	0.4
400	1	0	0	0	0	0	0